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THE WIRELESS WORLD

PRICE 6D NET

SEPTR 1916

Marconi ¼-kw. Transmitter

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Wireless and the Cinematograph

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Wireless Transmission of Photographs

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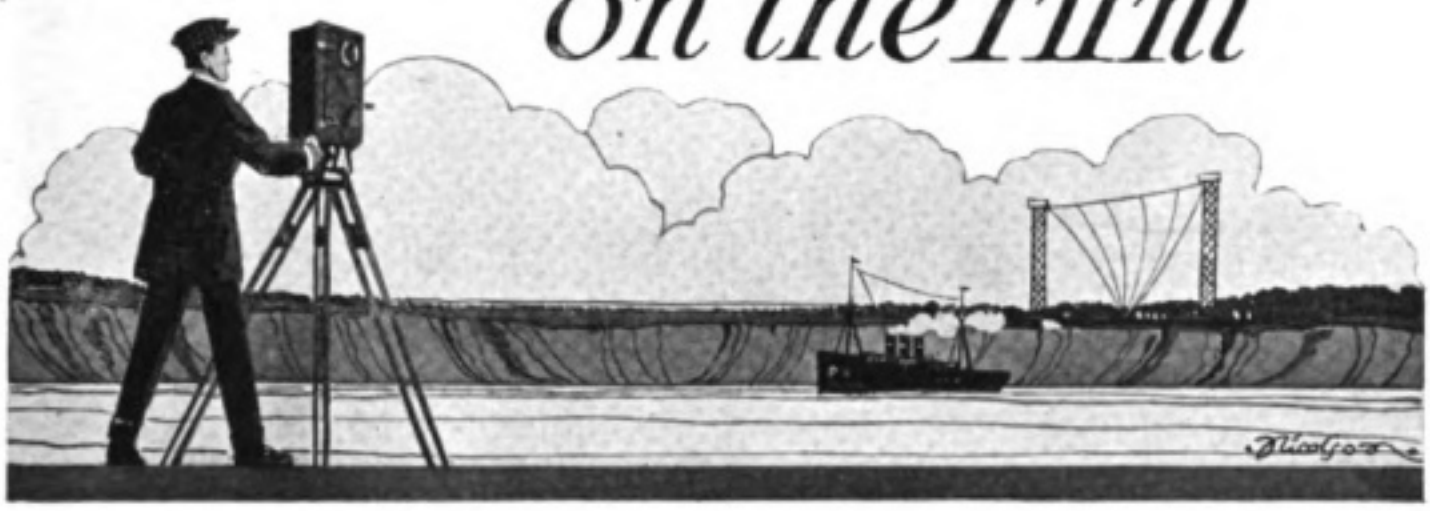
Wireless on the Film



THE wireless telegraph and kinematograph are both essentially modern inventions which have had a far-reaching effect upon our daily life. Both owe much to the genius of young men, and both have been responsible for the growth of organisations vastly greater than the pioneers ever dreamt of predicting.

In its own particular field, the kinematograph has wrought an effect every whit as revolutionary as that of wireless in the realm of maritime affairs. One by one its technical faults have been removed, so that we may now sit through long programmes without the fatiguing eye strain which accompanied so many of the earlier exhibitions; whilst, from the artistic point of view, the modern film is as far removed from the first crude and awkwardly produced pictures as a modern wireless telegraph station is separated from the crude oscillators of Hertz.

Wireless telegraphy has many dramatic possibilities unthought of in connection with the wire telegraph, and it is not surprising that kinematograph producers have from time to time called in its aid in the production of their plays. In most instances, however, the "wireless" portions of the production have been badly handled, the so-called "wireless apparatus" affording considerable merriment to all who are acquainted with the practical side of the science. But competition keen as a knife is gradually eliminating all error and falsity from film productions, and the crudities of the early films will soon be completely forgotten.

A representative of THE WIRELESS WORLD recently had an opportunity of viewing two excellent modern productions—one, entitled "Via Wireless," by the courtesy of Messrs. Pathé Frères, and the other, "Saved by Wireless," by the kindness of "Triangle Plays." The first revealed itself as an exciting drama, and the second as what is known in the trade as "a side-splitting comedy." A few notes concerning both of these plays will, we think, be not without interest to our readers.

The Pathé production, "Via Wireless," is an excellent example of a modern film produced with the greatest care and, by all appearances, a total disregard for cost. It is not difficult to understand how thousands of pounds may be lavished

upon a single film when we consider that a large number of copies of each production can be printed off, and each copy circulated among a large number of theatres, the rental for three days (a common period) amounting to many pounds. We understand that in the United States alone there are 120,000 moving picture theatres; whilst the number in this country runs into thousands. Colossal sums are thus earned by a single popular production, and in view of competition it is not surprising that exhibitors will have nothing but the best.

"Via Wireless" opens by introducing to us, one by one, and each in an appropriate scenic setting, the chief actors in the drama, and the play itself commences by revealing a meeting of the Cabinet at Washington to consider the coastal defence of the United States. The authorities shortly after call for quotations for one hundred 12-inch guns. The scene now changes to the office of Durant's Steel Works, a large firm who intend to submit tenders. Here the manager is seen to walk in to the Designs Department, with the purpose of instructing his leading draughtsman, Marsh, to put the designs in hand. While talking he notices on Marsh's board the drawings of a new gun which obviously excels those already produced.

Here the dramatic interest of the story commences in earnest, for Pinkney, the manager, sees a fortune in the new gun, and recognises that legally the firm can claim the benefit. He therefore promises Marsh £250 per gun under promise of

Photo b] [*Pathé Frères.*

"NOT TOO LATE TO THRASH THE VILLAIN!"

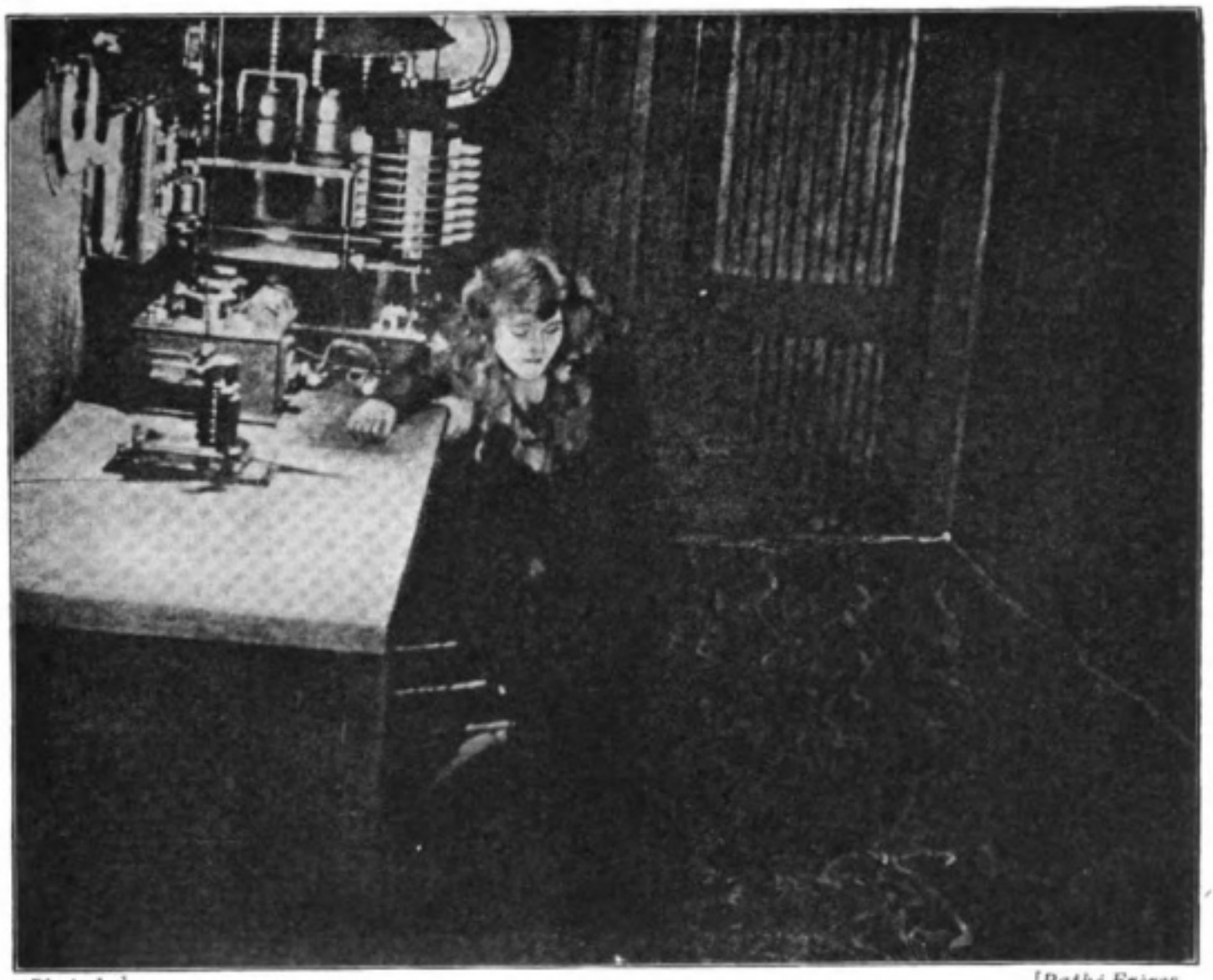


Photo by] [*Pathé Frères*

"FRANCES . . . SENDS A FRANTIC 'SOS.'"

secrecy, and promptly tries to make double that sum for himself by offering the invention to the firm as the work of an outsider, whom he calls "Ranström." Shortly afterwards Durant's Works are ordered by the authorities to construct one of these new weapons for test purposes, and in the event of trials proving successful an order for a hundred will be placed.

Watching carefully every detail of the play, we now find that the manager loves Frances, the Steel King's daughter, but is treated coolly by her for the reason that Lieutenant Sommers, who has appeared upon the scene, is a much more charming fellow. Whilst we are contemplating the love interest we discover that Sommers' call at Durant's is connected with an order from the Government to construct another test gun from Sommers' own design. Faced with the fact that if the Lieutenant's gun proves more successful than his own he will lose heavily financially, the manager plots to have the second gun ruined in manufacture.

At this point we are treated to some highly interesting pictures of what are supposed to be Durant's Steel Works, and for a considerable time the action takes place amidst flaming furnaces, giant crucibles, and rolling machines, all illuminated by a lurid glow. Here it is evident that we are viewing the "real thing," and we were not surprised on later enquiry to find that these pictures were actually taken in

the interior of the Pittsburgh Steel Mills, which were placed at the disposal of Messrs. Pathé for the production of these scenes.

Leaving for the moment the gun-production, we find Frances being conducted over a United States battleship by Lieutenant Sommers (in reality the Dreadnought *New York*, on which the Company were permitted to film some of the scenes), and introduced to the wonders of wireless. Here we see a modern wireless installation, complete in every detail. The heroine becomes fascinated with the new art and persuades her father to erect for her a small installation at her own home. Of course the Lieutenant finds this an excellent excuse to pay frequent visits, and takes the opportunity of teaching Frances to send and receive without help. The scenes in the home of the wealthy ironmaster were taken in the palatial residence of Commodore E. E. Benedict, at Greenwich, Connecticut, loaned for the purpose.

A further remarkable series of pictures in the steel works opens with a scene showing the chief draughtsman finding that the foreman in charge of the huge ingot from which Sommers' gun is to be forged is drunk and quite incapable of supervising the details of the work. Hauling him off to the manager, the draughtsman immediately reports the man, expecting, quite justifiably, that he will be immediately dismissed. Instead of this, however, Pinkney plots with the foreman

Photo by] *[Pathé Frères.*

SOMMERS RECEIVES FRANCES' DISTRESS CALL.

THE WARSHIP CLOSING UP TO THE YACHT.

to ruin the mammoth gun by placing it too early in the hardening bath. Rather than be dismissed, the man accepts the proposal, and as a consequence the giant casting is irretrievably spoilt.

An office-boy overhears the conversation and is able to give Sommers warning of the base plot, and the young Lieutenant immediately rushes to the works, too late it is true to stop the deed, but not too late to thrash the villain who was endeavouring to ruin his fortunes. Still further complications are introduced by the arrival during the "scrap" of the heroine, who mistakes the motives of the young Lieutenant and refuses to see him next morning, when, ordered hurriedly to the Dardanelles, he pays a visit of farewell. Disappointed, as she thinks, in her lover, Frances is inclined to favour the advances of Pinkney, and her father, unaware of the villainies which the manager has perpetrated, does everything he can to encourage the match. To gratify her parent, Frances gives consent, and embarks for a voyage upon her father's luxuriously appointed yacht, with Pinkney and her mother for an escort.

We now see some dramatic pictures of gun-testing, the giant Ranström weapon proving highly successful. The section of the film purporting to show the testing of the Ranström gun was really taken at Sandy Hook during the firing of some coastal defence guns. The Lieutenant's gun, however, bursts at the test, and we have a thrilling scene of the wreckage caused and the havoc surrounding the spot

where the gun was tried. The scene following the explosion is perhaps one of the most dramatic in the whole film.

A Government enquiry is immediately instituted, and as a consequence Sommers, who was stationed in the Bosphorus (a portion of which we are allowed to see in the film), is recalled; and the manager, who is on the yacht with Frances, is similarly recalled to give evidence. This being a film produced in war time, the dangers to navigation from mines are not overlooked, and we are given a thrilling underwater view of a chained mine, round which the fishes are swimming whilst the bows of the yacht are slowly approaching. Then a violent explosion occurs and the yacht is seen to be sinking rapidly.

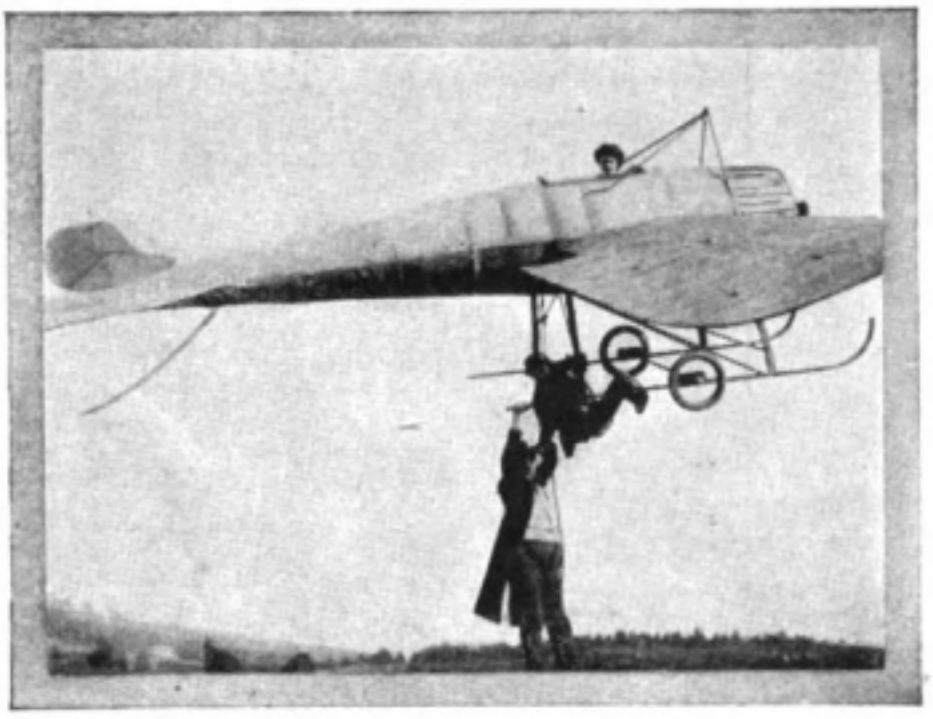
Frances, ever keen on wireless, by a lucky chance happens to be in the operating-room at the moment of the explosion, which so wedges the door that she is unable to get out. Meanwhile the cowardly manager, forgetful of his *fiancée*, leaves the yacht with all the crew. Frances makes good use of her wireless knowledge and sends out a frantic "SOS" through the ether, which providentially is intercepted by the cruiser on which Sommers is returning. Dramatic scenes take place in both wireless rooms, where modern American Marconi apparatus is installed, as will be seen from our illustration.

Once in safety aboard the warship, Pinkney remembers that Frances is still aboard, but by this time Sommers has learnt the fact for himself, and is soon speeding to the rescue in a fast motor-boat. Arriving in the nick of time, he saves the brave girl, and, as is to be expected, reconciliation takes place.

Several other thrilling events take place before the Committee of Enquiry meets, and secret service men have made searching enquiries which go to prove Pinkney's guilt. At the enquiry, which takes place at the works, the implicated draughtsman goes mad and fires the building, and in the ensuing panic the villain escapes in a motor-car, of which, however, he loses control and dashes, car and all, over a precipice to be smashed to pieces below. The remaining episodes need not be described except to remark that they are rather touching.

THE ASSISTANT SPY IS CAUGHT FLIRTING.

Needless to say the play is in parts frankly melodramatic and full of those coincidences round which such stories are written. As described in cold print it may seem far beyond the bounds of possibility, but seated in a comfortable chair before the screen, one loses one's critical powers in the interest of the film and its



FIGHTING IN MID-AIR.

fascinating setting. It must be stated, however, that wherever practical wireless is introduced it is properly handled, and although the operators are obviously not sending "Morse," the effect is sufficiently real to satisfy all but the most exacting. At least we have none of the weird and wonderful imitation wireless apparatus which to a critical eye has ruined so many films. Messrs. Pathé Frères are to be congratulated upon producing a play which is interesting both to the expert and to the general public.

Of quite a different nature is the film "Saved by Wireless," produced by "Triangle Plays." Here we have a staging almost as elaborate as that of "Via Wireless," but with an interest which is highly comical throughout. It is difficult to record in print the details of the plot, for at the end of the film we are left in a state of nervous exhaustion from the thrills and smashes we have witnessed.

Briefly then, the Minister of War loses his code book through the machinations of an arch-spy, and as usual immediately suspects the wrong person. Complications arise through one of the spy's assistants falling in love with the War Minister's daughter. The arch-spy learns of the defection of his assistant, and throughout the rest of the play a constant struggle takes place between the two. Meanwhile the wrongly suspected youth has eloped on a yacht with the girl, and owing to some mistake or other (we cannot remember exactly how!) a large dynamite bomb is placed aboard the vessel. The love-sick spy sends a warning message by wireless to the yacht and starts off in an aeroplane to the rescue. The arch-spy meanwhile endeavours to wreck the yacht at all costs, and has just extinguished the light in the lighthouse when the lovesick one drops off the aeroplane and switches it on again. Both spies manage to scramble on to the rope suspended from the aeroplane, and there is a struggle in the air, resulting in the chief spy being kicked off into space. He falls through the air for a considerable distance and lands on the yacht, which immediately blows up and ends his career. Providentially the other occupants of the vessel had left a few minutes before.

So far we have omitted all reference to the exciting chase of the aeroplane by the motor-car. Various policemen on motor-cycles and in high-power motor-cars chase the spies and one another, smashing up periodically on greasy roads, until we gasp and wonder how many dozen motor-cars and cycles are wrecked before the

RECONCILIATION.

film is completed. The wireless apparatus, as in the previous film, is not of the "fake" variety, although the method of manipulating it is not strictly according to the Postmaster-General's Handbook!

Those of our readers who are frequent visitors to motion picture theatres will be acquainted with the two comedians, Mack Swain and Chester Conklin, who play the leading *rôles*, and will agree with us that no funnier comedians could have been chosen for the parts.

Writing of wireless on films reminds us that the British Government have recently issued a series of kinematograph pictures showing how gun-firing is controlled by wireless. Reference to this will be found on another page.

The Marconi War Savings Association.

ON July 18th the London staff of the Associated Marconi Companies held a meeting at Marconi House for the purpose of considering the formation, under the auspices of the National War Savings Committee, of "A War Savings Association." The chair was taken by Mr. Godfrey C. Isaacs, Managing Director, whilst the objects and working of the scheme were admirably expounded by Mr. F. W. Raffety, a speaker attached to the National War Savings Committee. On the completion of Mr. Raffety's remarks, Mr. Isaacs rose and announced that, in order to encourage the staff not only to save but to provide money for the continuance of the war, the company were prepared to offer the assistance of their clerical staff and to advance the entire sum required to meet applications for War Savings Certificates free of interest, subject to such applications being approved and the subscribers undertaking to pay the amount so advanced, within the prescribed period, by weekly or monthly instalments deducted from salary.

Needless to say this kind offer was well received, and a large number of applications have been made. In this way the Marconi Companies' staff will have the satisfaction of knowing that they are contributing to the prosecution of the war not only by their daily duties but also with their savings.

New Wireless Magazines in Spanish and Portuguese

El Marconigrama and *O Marconigrama*

READERS of our magazine in Spain, Portugal, and South America will be interested to learn that, as already foreshadowed in the Editorial in the August number, it has been decided to publish editions of THE WIRELESS WORLD in both the Spanish and Portuguese languages. The new magazine, the first number of which will be on sale on October 1st, will bear the title *El Marconigrama* for the Spanish edition and *O Marconigrama* for the Portuguese. The contents will follow closely the lines of THE WIRELESS WORLD, and will contain a large proportion of similar matter, although to meet special needs a number of new features will be introduced. The highly attractive cover in colours, depicting a storm-tossed liner sending out into the ether the signal of distress, has been specially prepared by a well-known artist, and will be much admired.

For the first number a particularly interesting series of articles has been prepared. The well-known littérateur Señor Enrique Perez, to whom the editorship has been entrusted, will describe in the editorial pages the aims and aspirations of the new magazine, and among the literary features will be found the translation of Mr. Hall Caine's well-known play "The Iron Hand." As in THE WIRELESS WORLD, there will be instructional articles, technical articles, descriptions of wireless stations in various parts of the world, and all the features which have proved so popular in that magazine. A section of special interest will be that devoted to reviews of books appearing in Spanish and Portuguese.

It is no small tribute to the universality of the interest taken in wireless telegraphy that at such a time as the supreme crisis of the great World War the Wireless Press should feel justified in launching this new enterprise. Labour troubles, paper troubles, and transport troubles notwithstanding, the demand was too insistent to be denied.

The subscription rates will be eight shillings per annum, or $2 American currency, and single copies will be sent post free for 1s., or 20 cents. All communications should be addressed to the Editor, *El Marconigrama*, Marconi House, Strand, London, W.C.

Wireless in the Courts

AN engineer, named H. A. Livermore, has been fined £10 with £5 5s. costs in Australia for being the possessor of wireless apparatus without a licence. The apparatus was of small power, such as would be set up by an ordinary amateur; there were no aerials or detectors, and the apparatus would not receive signals.

PERSONALITIES IN THE WIRELESS WORLD

Mr. ANDREW GRAY, Chief Engineer, Marconi's Wireless Telegraph Co., Ltd.

THE chief engineer of the Marconi Company was born in Glasgow in 1873. He received his engineering education at the University and Royal Technical College of that city, winning the diploma of the latter for electrical engineering. His first post was that of assistant to the late Professor Andrew Jamieson of the Royal Technical College (Glasgow), and he afterwards became assistant electrician to the West India and Panama Telegraph Company on their cable steamer *Grappler*. For five years Mr. Gray continued in their service as assistant electrician, chief electrician, and telegraph engineer. During those five years he obtained valuable experience not only of technical matters relating to the laying and repairing of submarine cables, but also of the commercial side and the methods of operating and handling telegraphic traffic. Mr. Gray joined the Marconi service in 1899, and was sent to the Hawaiian Islands to superintend the installation of the Marconi system for the Inter-Island Telegraph Company. Here he had to train the native operators, as well as organise all the traffic arrangements and the methods of operating. In 1901 Senatore Marconi appointed Mr. Gray chief of the staff both for the "Wireless" and "International" companies, and his previous experience proved invaluable in enabling him to initiate and develop the systematic handling of ship and shore traffic. He continued to occupy his dual position until 1906, when the vast extension of the company's operations obliged him to hand over that part of it which appertained to the International Company to the late Mr. G. L. Bullocke. Since then Mr. Gray has been confining his attention to the superintendence of constructional work and the staff engaged thereon. In 1910 he received his formal appointment as Chief Engineer.

A New Marconi Low-Power Installation

The ¼ kw. Transmitter

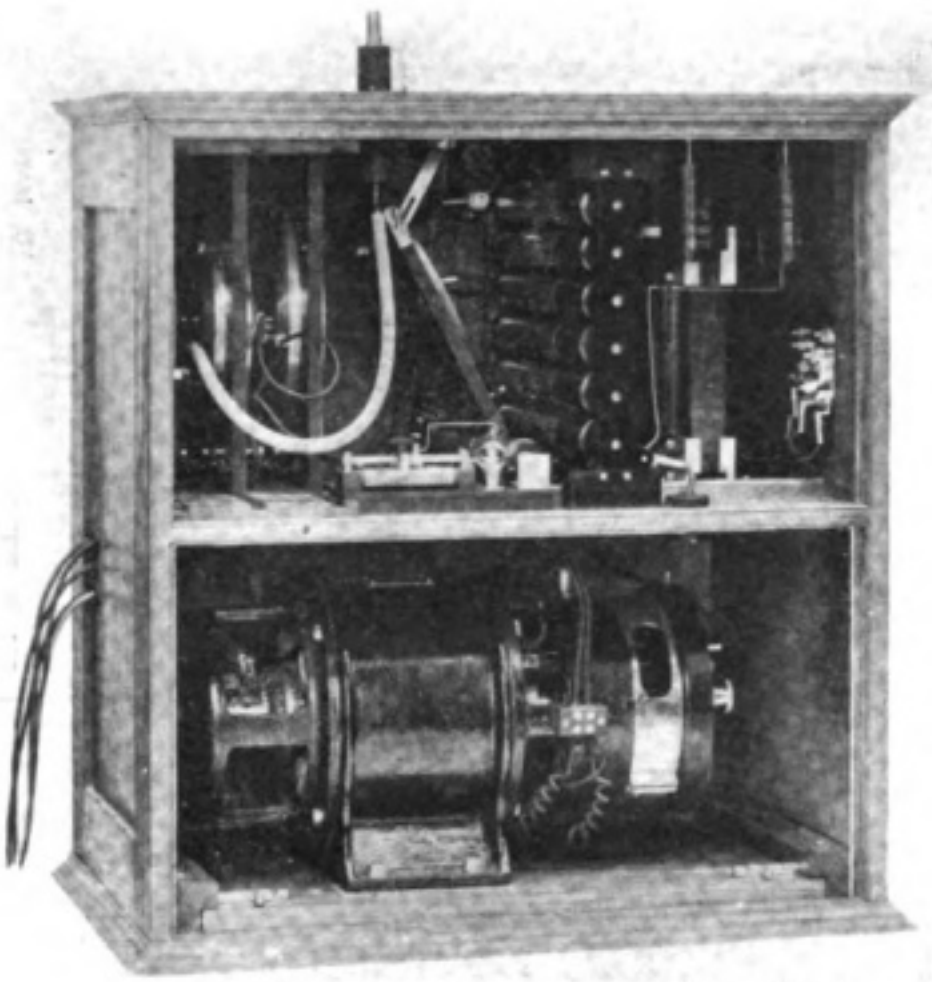
THE growth of the application of wireless telegraphy to vessels of small tonnage and the need of a moderate power installation for emergency uses on large vessels has caused the Marconi Co. to put on the market a ¼ kw. installation containing many novel features and characterised by the usual Marconi robust construction and efficiency.

The installation is capable of adjustment for the transmission of any wave-length between 300 and 600 metres, and the whole of the transmitting apparatus, including the motor alternator, is mounted compactly in a wooden cabinet. The cabinet is approximately 27 inches high, 26 inches wide, and 17 inches deep when closed. It is divided into two portions, the larger portion (lead lined) containing the motor alternator and disc discharger, the upper portion serving to hold the condenser battery, primary inductance, aerial tuning inductance, earth arrester terminal, wave shortening condenser, and other details. To protect the apparatus and to prevent inexperienced persons from coming into contact with the high tension circuits, the front of the cabinet is fitted with removable panels, which in general use are kept closed. This necessitates placing the manipulating key and the controlling switch gear outside the cabinet. From the accumulator battery, of which we shall speak later, continuous current is led through the switch gear to the motor alternator, consisting of a continuous current motor directly coupled to a 250 watt generator, which supplies alternating current at a pressure of 110 volts and a frequency of 300 cycles when running at a speed of 3,000 r.p.m. Attached to an extension of the framework of the motor alternator we find a containing chamber for the disc discharger, the disc itself being mounted on an extension of the motor alternator shaft. A suitable combined starter and regulator is furnished for the control of the

¼ KW. WIRELESS TRANSMITTER (CLOSED).

set. The transformer is of the closed magnetic circuit type, air-cooled, and designed to raise the pressure from 110 volts to approximately 5,700 volts (the pressure required for charging the condenser bank). Special air core protecting chokes safeguard the windings of the transformer from injurious induced effects from the high-frequency circuits.

Six tubular condensers are used in the condenser bank. These are constructed of specially selected glass tubes on which has been deposited electrolytically a coating of copper, both inside and out. All of these tubes are of the same dimensions, and are calculated to have the same capacity, and in the unlikely event of a breakdown a new tube can be immediately substituted. The condenser tubes are extremely strong from a mechanical point of view, and have an ample margin of safety for any electrical stresses to which they may be subjected.



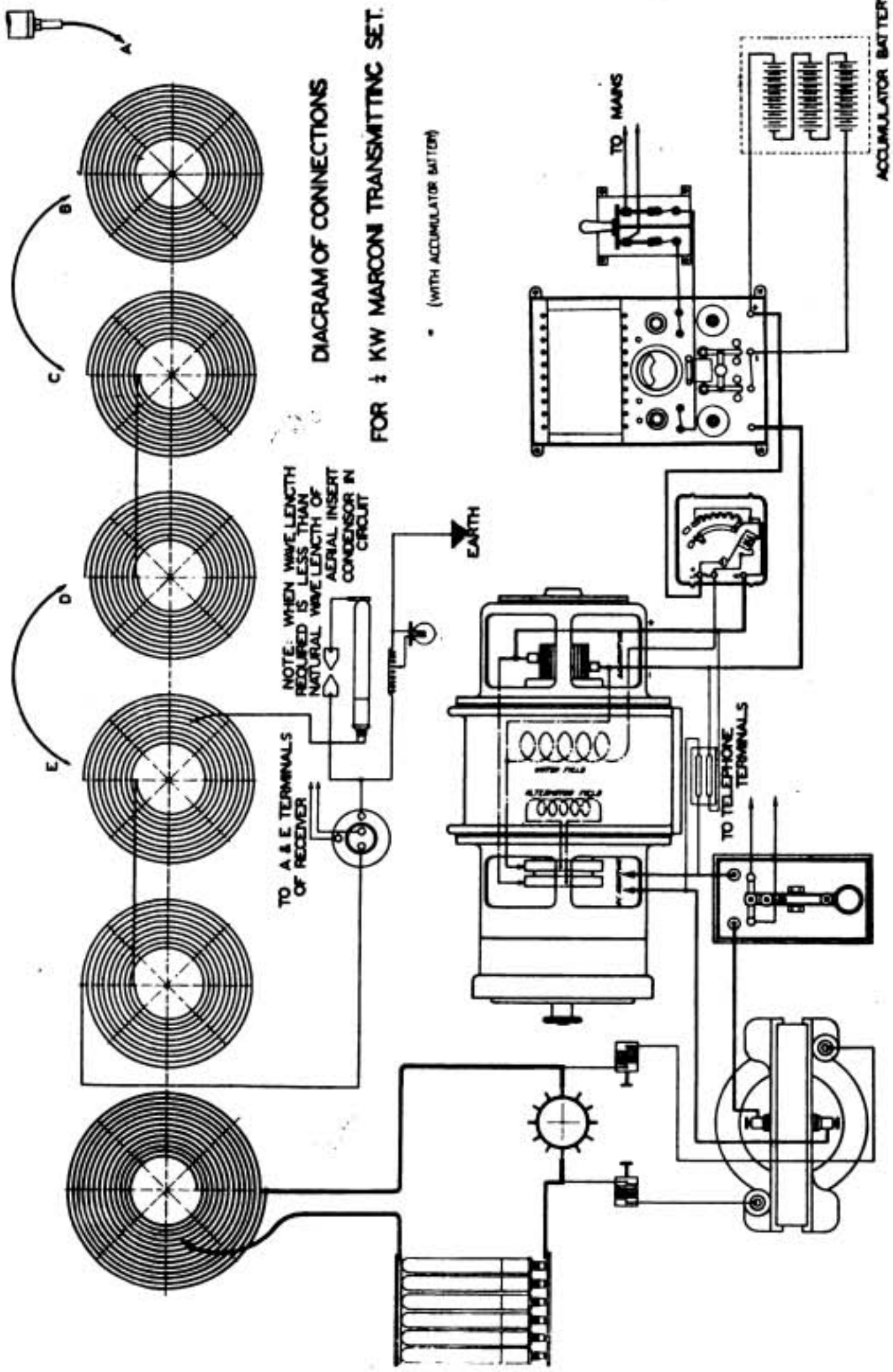
½ KW. WIRELESS TRANSMITTER (OPEN).

One additional condenser unit is furnished for the purpose of tuning the aerial circuit to wave-lengths less than the natural period of that circuit, when the minimum amount of inductance is included therein.

The disc discharger is of the insulated synchronous disc type mounted on an extension of the alternator shaft, and carrying a number of studs bearing a direct relation to the number of alternator poles, thus ensuring correct synchronisation of the spark frequency to the periodicity of the alternating current supply, and the consequent production of a spark of good quality and even tone. The spark frequency is 600 per second (twice the periodicity of the supply from the alternator).

The disc, as mentioned above, is enclosed in a casing formed on the body of the machine, and carrying the stationary electrodes, which are suitably insulated. Provision is made for the adjustment of these electrodes to meet normal wear and to enable the correct phase relationship with the alternating current supply to be obtained.

The transmitting jigger is of the independent primary and secondary circuit type. The primary winding consists of a flat spiral of bare copper strip mounted on a suitable framework by means of ebonite insulating supports, connections being made at various points on this spiral by means of substantial clip connectors, thus enabling the amount of inductance included in the high-frequency primary circuit to be varied to suit the required wave-length.



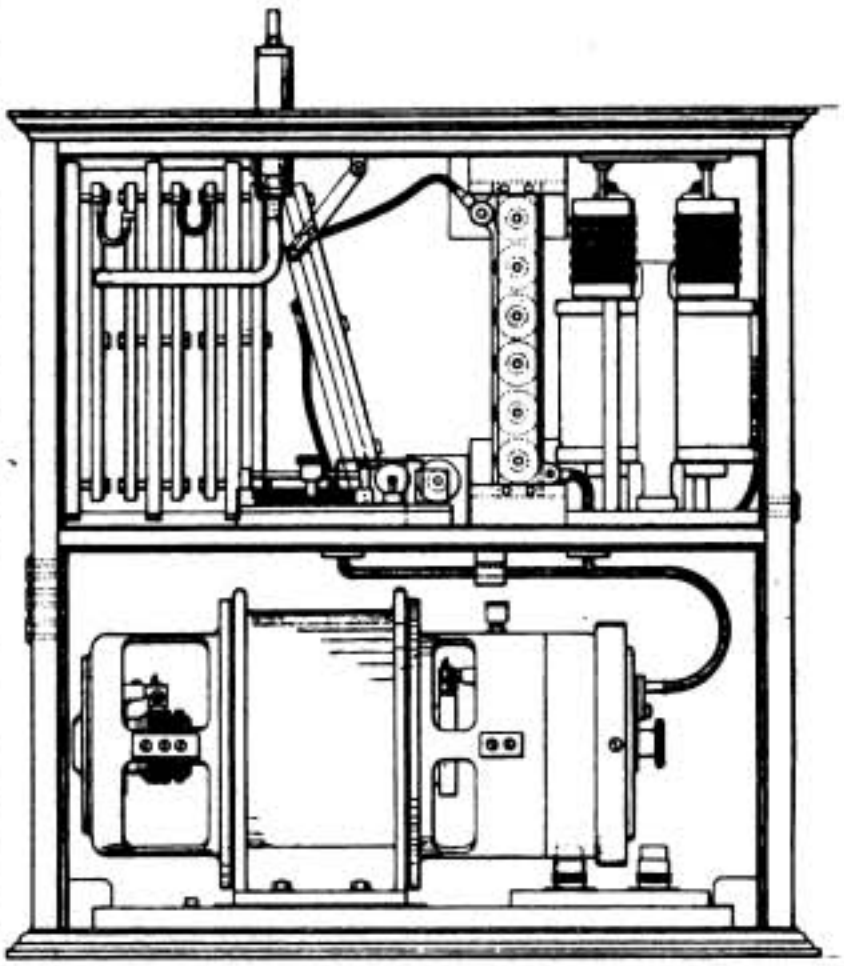
The secondary inductance consists of a number of flat spiral units, the various sections being connected up by means of flexible connectors stretching between one unit and another. A sufficient amount of aerial tuning inductance is provided to allow of the normal ship's aerial being tuned to the maximum wave-length without the need of external inductance.

The primary is hinged to the body of the cabinet and placed in front of the secondary winding, being fitted so as to swing outwards and allow of variation in the magnetic coupling between the primary and secondary circuits.

The manipulating key consists of a standard Marconi type wireless telegraph key, fitted with telephone short circuiting contacts on the back stops, serving to protect the telephones from strong induced currents while transmitting, and rendering it possible for the operator to listen in for the communicating station between intervals of transmission.

The accumulator batteries are contained in a cupboard designed to accommodate 30 special ship type 80-ampere hour cells. The arrangement of the cells in three tiers, 10 cells per tier, is chosen, as it allows of the cupboard being made of such dimensions as will allow of the same being secured to the back or side of existing deck structures.

Special care has been taken to ensure a free circulation of air through the cupboard. When the cupboard is placed in a sheltered position between the decks it is usual to fit at the top or side of the cupboard as most convenient, a torpedo or other approved type of induced draught ventilator.



INTERIOR OF CABINET SHOWN DIAGRAMMATICALLY

The electrical connection between the accumulator battery and the battery charging switchboard situated in the Marconi cabin is made by means of insulated cable, run in screwed steel piping.

Our illustrations will give readers an excellent idea of the general arrangement of the set, whilst the diagram of connections on page 440 will sufficiently explain the wiring. When the ¼ kw. set is used on small vessels as the main installation, a receiver, of course, has to be fitted. This consists of one of the Marconi standard crystal receivers, having a range of reception covering all wave-lengths between the approximate limits of 200 and 2,500 metres.

Digest of Wireless Literature

Wireless Signals and the Aurora.

The following letter, which appeared in our contemporary *Nature* recently, will be of interest both to operators and students generally.

"Regarding the magnetic storm and the auroral display of June 17th, 1915, " referred to by Professor Barnard and Father A. L. Cortie (see *Nature*, Vol. XCV., " pp. 450, 536, etc.), it may be of interest to place on record the following facts. " Independent reports presented by Mr. Tulloch, the meteorological observer, and " Mr. Henderson, the wireless operator, at Macquarie Island, lat. 55° S., each mention " the Aurora Australis of that date as the most brilliant noted in periods of one year " and two years respectively. It was also the only occasion in two years when it " was absolutely impossible to receive signals from any other station—even the " high-power plant at Awanui, near Auckland (New Zealand), which seldom failed " to make itself heard.

" Mr. Tulloch's reports for three days were as follows :—

" ' *June 16th*, 9 *p.m.*—Barometer (corrected) 28·460 in., temperature 37·4° F., " ' wind N.N.W., force 5 (Beaufort scale). Fierce gales in morning; fine clear night; " ' slight auroral glow in south.

" ' *June 17th*, 9 *p.m.*—Barometer 29·361 in., temperature 27·0° F., wind S.W., 7. " ' Snowstorms continued throughout the day: three inches of snow on the ground. " ' Squally S.W. winds and high seas. Barometer rising rapidly.

" ' Brilliant red aurora. Looked something like a Japanese fan opening and " ' closing. Its centre or base was a little north of the zenith and spread out from " ' about E.S.E. to W.N.W. The colours varied from bright green and purple to a " ' deep red round the edges. The display continued all the evening, and at 10 p.m. " ' it worked to the N.N.W., appearing to reach the northern horizon.

" ' *June 18th*, 9 *p.m.*—Barometer 29·658 in., temperature 27·8° F., wind S.W., 9. " ' Snowstorms throughout the day with fierce S.W. gales. Brilliant aurora visible " ' between breaks in the clouds.'

" Mr. Henderson reports :—

" ' *June 16th*, 8.40 *p.m.*—Very pale glow low down to the south.

" ' *June 17th*, 5.30 *to* 5.40 *p.m.*—Very vivid blanket form of aurora in the zenith, " ' then a large red bank to the north-east very low and close, and red to the north " ' red fades and glow remains.

" ' 10 *p.m.*—Streamers and blanket form, and ring to the west and north.

" ' The " atmospherics " heard in the wireless receiver varied in strength from " ' 0 to 5 at intervals of about thirty minutes.

" ' *June 18th*, 9.20 *p.m.*—Sky nearly overcast, but bright glow visible overhead " ' for a few minutes.'

" Although the auroral and wireless data appear to lack correlation, it may " be of interest to note the circumstances under which the long and short waves " (2,000 m. and 600 m.) from Awanui, near Auckland, were received at Macquarie " Island

" Of the six nights when both wave-lengths were recorded, the 600-metre wave " was much the stronger; on three nights when the aurora was reported the longer " wave-length was the stronger. On the remaining night the longer wave was again " the stronger, but the sky was overcast and the moon approaching the full. An " aurora, if there had been one, could scarcely have been seen in the circumstances.

" (Signed) H. A. HUNT
" (Commercial Meteorologist).

" Meteorological Bureau, Central Office,
" Melbourne, May 24th."

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A NEW TUNGSTEN-MOLYBDENUM ALLOY SUBSTITUTE FOR PLATINUM.

In view of the importance of platinum in wireless telegraphy, readers will be interested to hear that the discovery of a substitute was announced at a recent meeting of the American Institute of Mining Engineers in New York, by Dr. Frank Alfred Fahrenwald, of the Case School of Applied Science, Cleveland, Ohio. We are indebted to the *Electrical Experimenter* for the following particulars.

To appreciate fully how far-reaching is this discovery one has but to consider that platinum is now more than four times as costly as gold, being quoted early in March at between £17 and £18 an ounce.

A substitute for platinum has now been found in alloys of tungsten and molybdenum. These metals have, of course, long been known and used, but it has not hitherto been known how they could be made to resist oxidation.

Dr. Fahrenwald conducted experiments that led to the solution of this problem. Tungsten and Molybdenum possess many characteristics in common. The former melts at about 3,000 degrees C., the latter at 2,500 degrees C. They are practically insoluble in any of the common acids, their tensile strength exceeds that of steel, they can be drawn to finer threads than any other metals, while their specific gravity is 70 per cent. greater than lead. In recent years tungsten has been replacing platinum in the automobile industry. Their co-efficient of expansion is 30 per cent. lower than that of platinum.

The serious objections to them were that they oxidised easily at a red heat and that they would not readily solder with gold and its alloys. Moreover, the larger wires were quite brittle.

The present investigator discovered that tungsten and molybdenum emerged from a bath of molten gold with a beautiful impervious coating. This removed the objection of corroding, but the metal was still as brittle as glass. Dr. Fahrenwald then set to work to discover a way to overcome this, and tested at various temperatures and under various high pressures many combinations of tungsten, gold, molybdenum and palladium. He also devised a special electric furnace giving 3,000 degrees Centigrade. The inventor made tiny briquets of these blends by submitting finely divided powder to a pressure of more than 300,000 pounds to the square inch. He placed these in the furnace and treated them to temperatures ranging from 500 degrees to 2,800 degrees C.—the highest temperature ever used in treating a metal —for periods of from one minute to one hour, and hammered them while hot.

The best results were obtained with pure tungsten molybdenum, heated to 2,300

degrees C., for one minute, the crystals being fine and the ingot quite homogeneous. These were forged without difficulty. An alloy of tungsten and molybdenum half and half was produced in wrought form that gave excellent results.

Dr. Fahrenwald summed up the work by saying :—" Except in two respects, " pure ductile tungsten and, to a lesser degree, molybdenum, meet all of the specifica- " tions of a practical substitute for platinum and its alloys. These two defects are " its ease of oxidation and the difficulty with which it can be soldered, and they have " been overcome by coating with a precious metal or alloy, the resulting material " being in many ways far superior to platinum or its alloys."

Tungsten and molybdenum are not nearly so expensive as platinum. The former was quoted in December at £600 a ton for 60 per cent. ore. It is now even higher. Molybdenum ore, which was £150 a ton before the war, was quoted in February at £720. These metals are necessary to the making of high speed tool steel, as they prevent it from losing its temper even when red hot. They are also in great demand by makers of artillery and ammunition. Prospectors are hungrily seeking deposits of tungsten ore. The world's largest deposit of molybdenum is said to be located at Catherine Hill, in Hancock County, Me.

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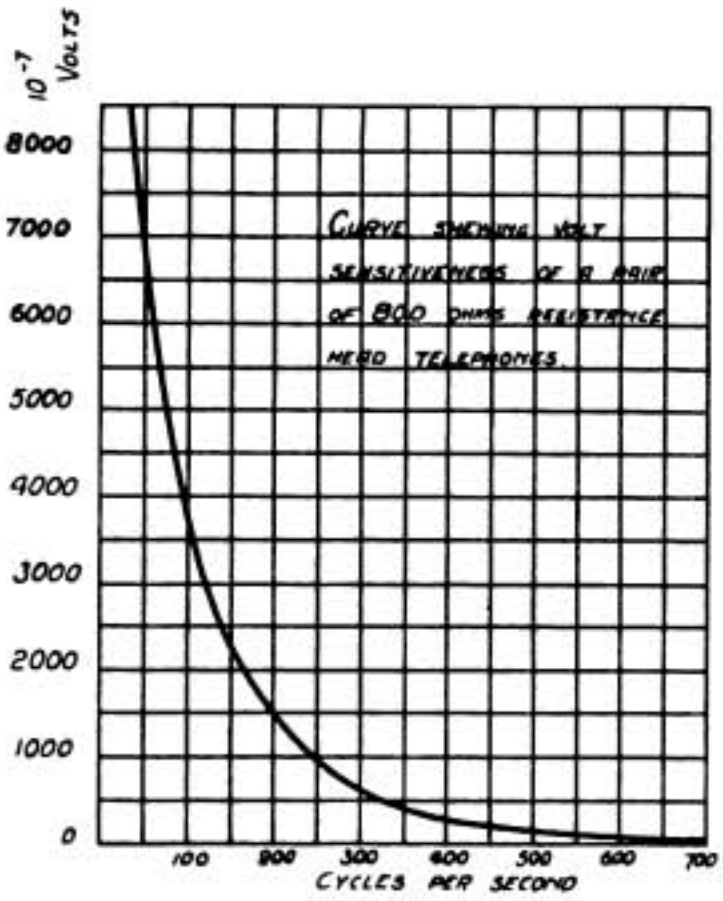
HIGH SPARK FREQUENCY IN RADIO-TELEGRAPHY.

An article in a recent number of the *Electrical Experimenter* by P. G. M. Clute contains some interesting details regarding high spark frequency.

It is certainly remarkable, says the writer, in the light of recent researches to increase the working range of radio-telegraphy that so little attention has been paid to the advantage of high spark frequency. One apparent cause of this neglect is the unfounded, though widespread, belief that the newer and recent types of high-resistance telephones such as are generally employed do not exhibit any great change of sensitiveness with variations in the frequency.



A great number of scientific observers, among whom are Wein and Lord Rayleigh, have noted that the telephone is more sensitive for high than for low frequencies.

With these investigations in mind, the U.S. Bureau of Standards has carried out a similar investigation on telephones of the type now used in radio-telegraphy. For the purpose a pair of head telephones of about 800-ohms resistance was taken. The Bureau has a set of dynamos in its laboratory ranging in frequency from 60–900 cycles per second and giving nearly pure sine waves, as free from overtones as possible. A current of from 80 to 100 milli-ampères was

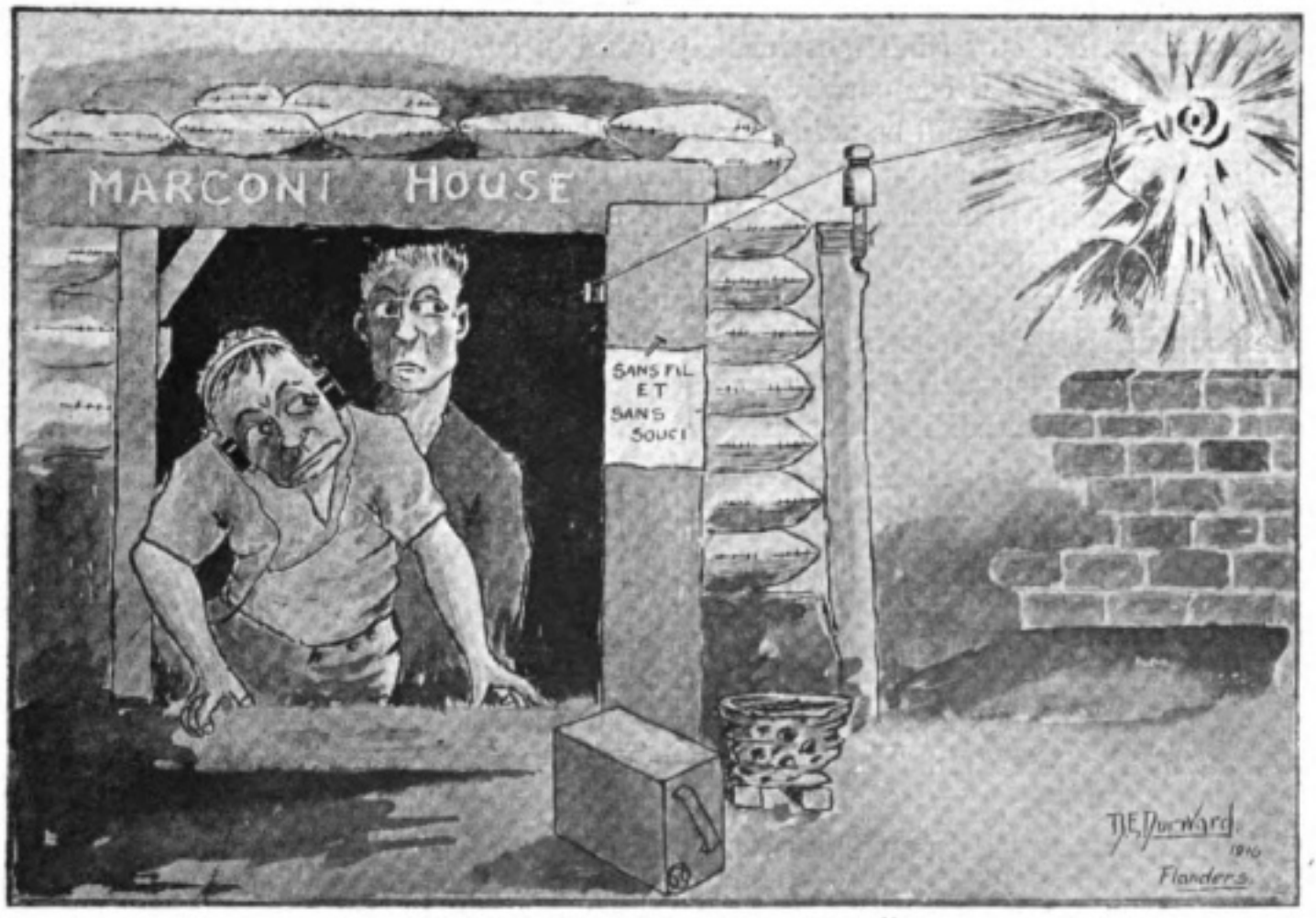
measured on a very sensitive hot-wire instrument and was then shunted through non-inductive shunts so as to cause sufficiently small fall of potential over a slide wire of known resistance; from this the requisite E.M.F. to just produce an audible sound in the telephone was taken.

Curve 1 gives the graphical representation of these results, and it will be seen that between 60 to 900 cycles the change in volt sensitiveness is over one thousand times.

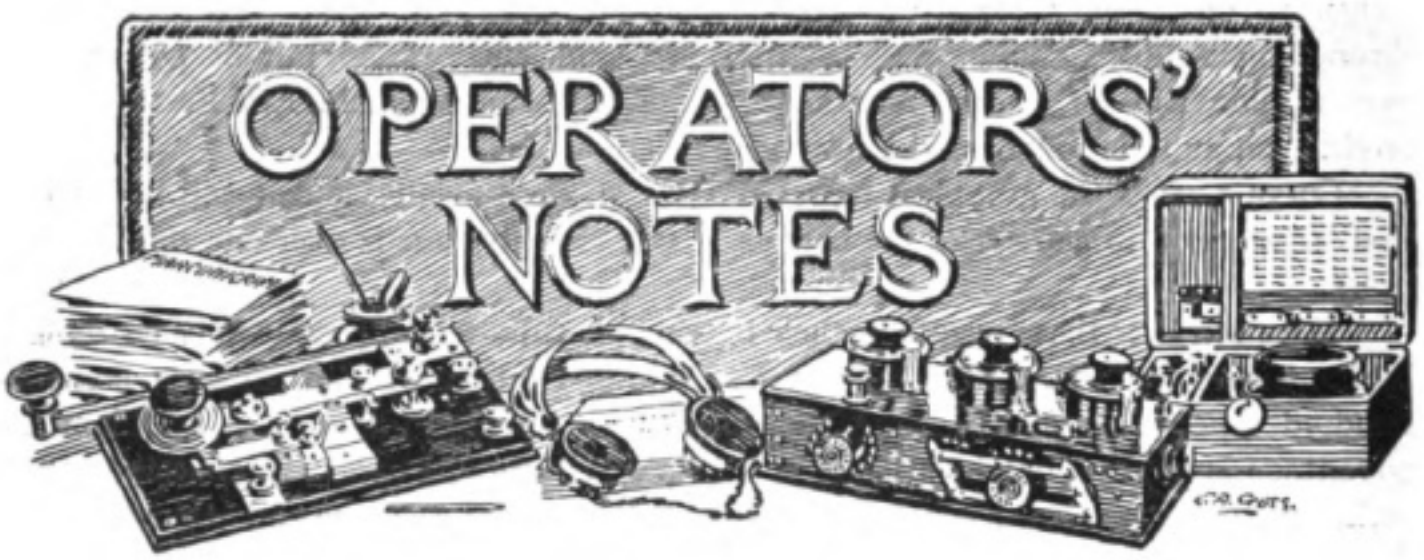
If we consider these results in their bearing on radio-telegraphy, it appears that by increasing the spark frequency at the sending station we can increase many hundred times the effective sensitiveness of the receiving station. An additional advantage is pointed out in utilising a high-pitched musical spark, in that the ear picks out such signals with ease in the midst of ordinary interference and atmospheric disturbances.

Another distinct advantage is gained by spreading a given amount of energy over several sparks instead of concentrating it into one, in that the potential differences are reduced, resulting in a reduction of condenser losses, which in the average radio station amount to a considerable part of the total power.

Oh! that Aerial!



"THERE IT GOES AGAIN, BILL."



Notes on Crystal Receivers.

An operator coming for the first time to a crystal receiver, after experience with the magnetic detector and multiple tuner, will find many points of difference, and many little practical details to be studied before he is able to get the best out of the instrument. He will realise that he is now confronted with a receiver in which the adjustment of the detector, as well as of the tuner, requires his careful attention when best results are to be obtained. Directly he comes on watch the operator should adjust the crystal of his receiver to the greatest sensitiveness, using for this purpose the testing buzzer. The buzzer itself must always be kept in good order, and is in its most useful condition when it gives a clean, musical note. With the carborundum detector (that most usually fitted in crystal receivers) the setting of the crystal itself is a comparatively easy matter. The steel plate which presses against the crystal should be adjusted so that the pressure is firm but not too hard, or the brittle carborundum will be likely to break off. He should next see that the battery is in circuit, and then with the buzzer-key depressed the slider of the potentiometer should be varied until the best signals are heard. Care must be taken that the buzzer signals are not too loud, otherwise it will be difficult to ascertain the point of best adjustment. It is as well occasionally to move the crystal slightly in its holder, the buzzer key being depressed meanwhile, as in some positions better signals are obtained than in others. This must be done with great care as carborundum is extremely brittle, and many crystals have been spoiled by careless handling.

Another important fact with which the operator is faced is that there is no "std-bi" position of the kind that is obtained with the multiple tuner and magnetic detector. The crystal, being a "potential" detector, must needs be placed in a separate circuit in which the pressure has been stepped up, and not in series with the aerial, so that the "std-bi" position of a crystal receiver is really a "tune" position with very tight fixed coupling, but no intermediate circuit. This is important to remember, as the "billi" condenser must be adjusted for best results on "std-bi" as well as on "tune."

It will be noticed that much looser coupling is obtainable with the crystal receiver, with a consequent increase in the sharpness of tuning. This valuable feature should be used to the full for eliminating and reducing interference.

"Synchronous Signalling in Navigation"*

A STUDY of the causes of shipwreck immediately reveals the fact that the great majority of these disasters owe their origin to fog and the difficulties of navigation occasioned thereby. Any contribution to the science of signalling which may serve to reduce the risks of the mariner who has the misfortune to encounter these adverse atmospheric conditions will therefore be welcomed by all interested in navigation. The purpose of Professor Joly's book is to explain a system of his own devising by which the difference in speed of propagation between sound, light and wireless signals is turned to use for the estimation of position of a ship at sea.

The discovery of a speed of propagation of sound signals dates from 1827, when Colladon and Sturm carried out experiments on the Lake of Geneva. Students of physics will be familiar with these experiments, which consisted in transmitting from a boat moored on the lake simultaneous light and sound signals to an observer in a second boat at a distance. The sound signals were transmitted from a submerged bell suspended from the first boat, and the light signals by the ignition of a charge of gunpowder, the ignition apparatus and the hammer of the bell being mechanically connected. By observing the interval elapsing between the flash and arrival of the sound of the bell through the water, a determination of the speed of sound transmission in water became possible. In experiments over comparatively short distances such as were here dealt with, the time taken for the light flash to travel between the two boats is quite negligible. The interval of time elapsing between the sight of the flash and the reception of the sound signal gives an accurate indication of the speed with which sound travels in water—namely, 4,700 feet per second.

Sound in air, however, travels at a much slower speed, the distance traversed in one second being but 1,100 feet. If now a signal station on the shore be made to send out two simultaneously emitted signals, one, say, in air and the other in water, a ship off the coast receiving these signals can determine her distance from the station by noticing the interval or lag between the arrival of the faster-moving signal and the slower-moving signal. The accuracy with which the distance is determined will, of course, depend upon the observer and the methods he adopts for including the time interval between the signals. Experience at races has shown that it is possible to make time estimations with an error not greater than a fifth of a second, so that by observing the time lag of the slower signal (when dealing with signals in air and signals in water) the observer would be able to estimate his distance within a few hundred feet. However, the transmission of aerially-borne sound signals in fog is erratic and unreliable, and the use of submarine sound signals and wireless would be far more practicable. With this combination we are able to estimate distance within 1,000 feet, the larger margin of error being due to

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* *Synchronous Signalling in Navigation*, by J. Joly, M.A., D.Sc., F.R.S. (London: T. Fisher Unwin, Ltd. 2s. 6d. net.)

the smaller time lag between the submarine signal and wireless compared with the aerially-borne sound signal and the under-water signal.

Of course, the success of a system such as this depends largely upon the accuracy of timing by the observing officer. A chronograph is an easily operated instrument, and the interval between the receipt of signals may be timed, just as we time the interval between the arrival of the competitors in a race. A source of error which will occur to many readers is that due to the "personal equation"; this, however, is not so great as would appear. Writing on this point, Professor Joly says: "It "is important to note that the degree of accuracy attainable in the readings is "enhanced by the fact that the errors of 'personal equation' must be all of the "one sign and hence tend to cancel in the successive observations which go to each "determination. The observer necessarily in every case first hears the signal "and then makes the record. The delay (which constitutes the personal equation) "between receipt of the signal and the making of the record tends to be the same "for the receipt of the faster and slow-moving signals. But it is the *difference* "in time between the record of the one and the other which matters. Hence the "error is more or less eliminated."

The need for a chronograph may be eliminated by a system of sending out the faster of the two signals at such accurately timed intervals as will allow them to take the place of the time-measuring instruments on board ship. Thus if we arrange to emit thirty successive repetitions of the faster signals timed to intervals of one second, the arrival of the slower-moving signals can be timed by noticing how many of the "second" signals have been received beforehand.

An advantage of Professor Joly's system is that not only can the distance from a given point be ascertained, but also its bearing. For this latter purpose it is necessary to make at least two observations. Quoting Professor Joly again: "In this case the sailor draws a line on a piece of paper representing his own course. "He places a mark on the line representing his position when he heard the signal, "and from this point he describes a circle to the radius of five miles or whatever "the distance was. He now awaits another signal. When it comes he gets a new "distance—four miles—and he makes a second mark on the line at a distance "from the first mark corresponding to his run in the interval between the signals, "and, always to the same scale of distance, he strikes from the second point a circle "to the radius of four miles. This circle in general intercepts the first circle at "two points. The signal station is at one or other of these two points." In nine cases out of ten the problem is completely solved by this information, but if necessary a third observation will determine at which of these points the station is situated.

One section of the volume is devoted to the consideration of how collisions may be avoided, and here the author describes an instrument of his devising which he calls a Collision Predictor. This is really a calculator with scales (to be set in accordance with the observations) which shows at once whether collision is likely to occur, and if so the direction in which it is threatened.

The whole system of synchronous signalling as elaborated and described by Professor Joly is most ingenious and interesting, but the extent to which it will

compete with the purely "Wireless" Direction Finder invented by Bellini and Tosi and perfected by the Marconi Company is open to question. Those who are acquainted with the latter invention will be aware that it can be used for ascertaining distance as well as direction by means of two observations and simple triangulation. It also has the advantage that but one set of signals is required and these need not be timed in any way. As this is not the place for the discussion of the relative merits of the two systems, we will leave readers to make the interesting comparisons for themselves.

The whole volume is most readably written, and the author is to be congratulated upon his lucid and full explanations of the various points which have to be considered. We are surprised that Professor Joly is apparently in ignorance of what has been done in purely "wireless" direction finding, for he says on page 30. "hitherto, when sights of the coast were not available, *to soundings alone* could "the mariner turn for help when the safety of his ship required the determination "of his position on the chart." (The italics are ours.)

In view of the author's extensive acquaintance with the subject, one would not expect to find, as is frequently the case, the misuse of the word "knot" in such phrases as "a distance of four knots." A "knot" is not a distance but a measure of *speed* meaning a nautical mile *per hour*, so that the statement "distance of four "knots" means a distance of four nautical miles per hour!

The book is excellently produced and can be recommended to all who are interested in the problems of navigation and the lessening of the dangers to which the mariner is exposed.

Edification Section

CONDUCTED BY OUR IRRESPONSIBLE EXPERT.

Now, what about you amateurs and all the stuff you read. D'you merely read the funny parts and slowly run to seed? Or do you study theory in the way you ought to do, preparing for the happy time when peace is really true? Don't think that when the war is o'er and amateurs are free that you can bring your aerial out and tie it to a tree, performing all the fancy tricks that you were wont to play before the Government arrived to take the gear away. Oh, no, that's not the kind of thing the future has in store, so don't let idle thoughts like that delude you any more! The Government will say to you: "Look here, my dear young man. If you want to fix your wireless now according to this plan, you've just to let us see you *know* how all the circuits run or else ther'll be an end to such as you who want the fun. Then you'll go into an office right in front of lots of nobs who'll elicit information from between your frantic sobs while you tell them blushing crimson that you haven't Bangay's Book and at Hawkhead's splendid treatise you just hadn't time to look. So contemplate with humbleness the error of your ways and think how application is the only thing that pays.

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Wireless Telegraphy In the War

Radio-telegraphy at Every Turn.

We have on many occasions referred to the fact that Wireless Telegraphy nowadays enters into so many spheres of operation, that there are few matters of public importance without a wireless side to them. It might have been thought that the burning question of Ireland, a political sore that has been kept open for all these weary years and which seemed lately in a fair way to be healed, would not be concerned with this ubiquitous science. Yet when we read the memorandum recently sent to Members of Parliament by the Navy League, we find the following sentence, which contains the gist of their "warning":

"Whatever sea power protects Ireland, a country that can never be inde-
"pendent of the strongest sea power in Europe, must control the telegraphs, the
"telephone system, the wireless system, the heliographs and semaphores, the
"petrol and the heavy oil fuel required by submarines."

We recently saw how, during the Sinn Fein rebellion, the insurgents took full advantage of the facilities afforded by radio-telegraphy, and issued their proclamation of an Irish Republic to the world through that medium. The picture, we believe an entirely fancy one, drawn by the Navy League of a possible hostile Ireland, acting in conjunction with a foreign enemy and in full possession of the wireless installations, constitutes a forecast of what must never be allowed to eventuate. Clifden, at present the most important commercial wireless long-distance station of supreme importance for handling United States traffic, would be a potent instrument of evil in the event of its falling under the control of enemy hands. Of course, the Navy League is not altogether the purely non-political body which it professes to be, and its manifesto is largely an excursion into the realms of fancy. But the fact that, in dealing with the subject, it finds itself obliged to give a prominent place to the consideration of wireless, constitutes a fresh tribute to the importance which radio-telegraphy plays in every department of modern national life.

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Wireless Direction of Artillery.

One of the most interesting developments in the awakening of our British Brynhildr by the Siegfried of War is the issue of cinematograph films calculated to arouse

popular interest and sympathy in the doings of the British forces on land and at sea. One of the most significant of those recently issued shows some of the great British guns in action with their fire directed by wireless from aeroplanes. In THE WIRELESS WORLD we have often described the process, and here we have it pictorially illustrated. An observer sends a radio message for fire to be opened, this is then transmitted by telephone to the battery, and the guns begin to speak. The observer

Photo by] *[Newspaper Illustrations*

A FRENCH WIRELESS SECTION AT A BRITISH POST.

notices perhaps that the range has not been correctly calculated; sends fresh messages to put the matter straight; elevations are altered, until the shells fall true on the German position, and the observer congratulates the gunners with his wireless "O.K." But what a difference it would have made in neutral countries if only we had started earlier! A correspondent writing from Zurich the other day saw a Swiss audience so enthused by British films of this description that the manager of the cinematograph establishment felt himself obliged to allay the demonstration by substituting others for the more exciting rolls, which he had intended to put on, illustrating some of the exploits of the British Navy.

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NAVAL AIRMEN ASHORE.

We print two pictures, on the following page, illustrating scenes "somewhere "in England." Under official guidance we learn the advisability of leaving

much to the imagination, and our readers can fill in the locality at their pleasure. The Royal Naval Air Service, as its name implies, forms a branch of the British Navy, although much of its work is done on terra firma. Of our two pictures, the one below depicts two operators hard at work listening to the messages conveyed to them through the medium of the aerial, one of whose masts stands at the end of the meadow. The same "crew" forms the subject of the top picture on this page: here, however, they are grouped at the bottom of one of the masts which they themselves have erected. Readers will notice that the complement carried by this British cruiser on dry ground consists of two operators and a motor driver. "Jack" ashore is as easily and unmistakably a seaman as "Jack"

Photo by] [*L. T. Sanderson.*

Photo by] [*L. T. Sanderson.*

afloat, and the rollicking spirit of the sea which he carries about with him wherever he goes constitutes one of his most attractive characteristics.

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An Advertising Bluff.

A great deal more attention than the occasion warranted was attracted by the voyage of the German submarine *Deutschland* to the United States. As pointed out at the time, the crossing of the Atlantic had been effected by a number of British submarines many months previously. However, our German imitator got through, although as yet we do not know with certainty by what method. Some say that it was with the assistance and under the convoy of a falsely styled "neutral" supply ship; others that she did it fairly "on her own." However that may be, she got there; and one of the first things that the Captain did on his arrival was to refuse to seal his wireless apparatus in accordance with the United States regulations. The authorities at Washington, rather hastily from our point of view, recognised her status as that of a merchantman, and she has thus been enabled to make a prolonged stay; with the result that a fortnight after her arrival the United States authorities insisted upon the sealing of the wireless, and sent a radio inspector to superintend the operation. The German Commander will find his return journey less easy than his outward. All sorts of dramatic devices were attempted in order to create mystification as to the start. The U.S.A. authorities, not unnaturally suspicious of German violations of neutrality, refused to permit the captain to send wireless messages to Berlin via the Tuckerton station. The Kaiser, therefore, who is said to have received by wireless the report of her arrival, will have to "possess his "soul in patience"" till she arrives — or is "reported lost."

Photo by] *[Topical.*

THE GERMAN COMMERCIAL SUBMARINE "DEUTSCHLAND" LYING IN HARBOUR AT BALTIMORE.

War Notes

Not long ago the Press came out with an announcement to the effect that the Dutch General Headquarters Staff had issued a long *communiqué* stating that the Army of Holland is now thoroughly prepared and equipped for any possible war. We do not know, of course, whether there may have been any political idea in the issue to the public of those documents, but it certainly possessed interest from many points of view. From that of radio-telegraphy, we may note that amongst the important items specifically referred to is the organisation and formulation of automobile stations for wireless.

Dutch Field Wireless.

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We were rather amused to read a number of notes published a short while ago by the well-known sportsman Mr. F. G. Aflalo. This well-known writer, after talking on the various " Wireless Warnings " which he had received in the course of his voyages during the present war, gives a list of the number of his old sea " Homes from Home " which have suffered destruction at the hands of the German Sea Wolves. They number four, and Mr. Aflalo is at considerable pains to explain that it would be very unfair to look upon him as a " Jonah." To quote his own words, " I am " not, exactly ! "

Sport and Travel.

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A recent description of " A Battle Cruiser's rigging loft " is mainly devoted to an enumeration of the rigging which no longer finds a place on our men-of-war. The only " top hamper " which has been added (instead of subtracted) since Nelson's day consists of the wireless aerial, which is thus dealt with by the writer : " The web of steel which catches the pulses " of the wireless current needs careful fixing and tending by the " rigger, though its insulation and use is controlled by the electrician. . . . The " platform, which forms at once a look-out and the station for the searchlights, is " fixed at the top of a steel rod, above which a few more yards of steel lifts the wireless " web well clear of the ship."

Warship Aerials.

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It is very easy to make allegations, which, when investigated, prove to be totally unfounded in fact. It will be remembered that in the summer of 1914 a mutiny on a small scale occurred at Singapore, and a British journal published the statement to the effect that a prisoner in a detention camp there had been proved by the court to have a wireless installation in his bungalow and was sentenced to a term of imprisonment after the war for breaking parole. The newspaper added that this traitorous prisoner was asked to dinner by the Governor of the Colony. Sir Arthur Young, the official in question, instituted an enquiry, and was able to report that no prisoner was convicted or even tried by the court for having in his possession a wireless installation ; no prisoner had broken his parole, and none had been "invited to Government House to dinner or any other meal." We wonder how much unnecessary trouble and expense was expended in disproving this baseless assertion.

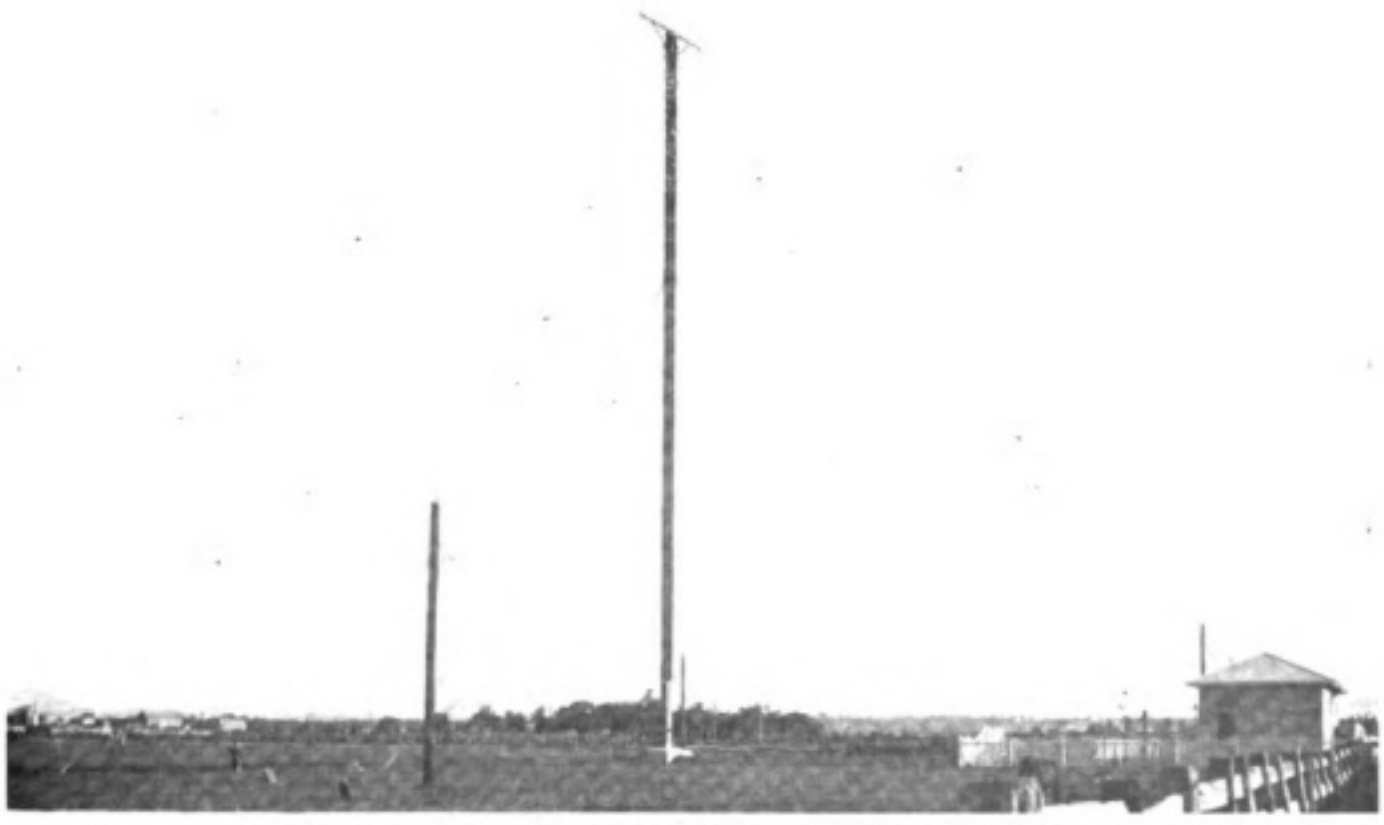
Baseless Allegations.

The Wireless Stations of Australasia

(FROM OUR AUSTRALIAN CORRESPONDENT.)

HAVING dealt in a previous number with the history of wireless telegraphy in Australasia, we think it will not be without interest to describe some of the radio-telegraph stations in that part of the world, thus supplementing the information already given.

The wireless telegraph stations in Australia, New Zealand, and surrounding islands are for the most part substantially low or medium power stations designed for ship and shore communication. Although those at present in existence have all been established in recent years, some time before the establishment of permanent stations was undertaken, two Marconi stations were erected for demonstration purposes, one at Point Lonsdale, near Melbourne, and close to the entrance to Port Phillip, the other near Devonport, on the northern coast of Tasmania. These stations were erected by the Marconi Company and will always be remembered as the earliest stations to work in that part of the world. Development, however, was not rapid and those stations remained unused for several years. For the information of the technical reader, we may say that they consisted of an earlier type of Marconi 1½ kilowatt station, and their main features included a Campbell 6-h.p. oil-engine, driving a 1½ kilowatt a.c. generator, which supplied current at 60 cycles frequency to an oil-cooled transformer. A bank of Poldhu-type condensers was charged from the secondary circuit of the transformer : the



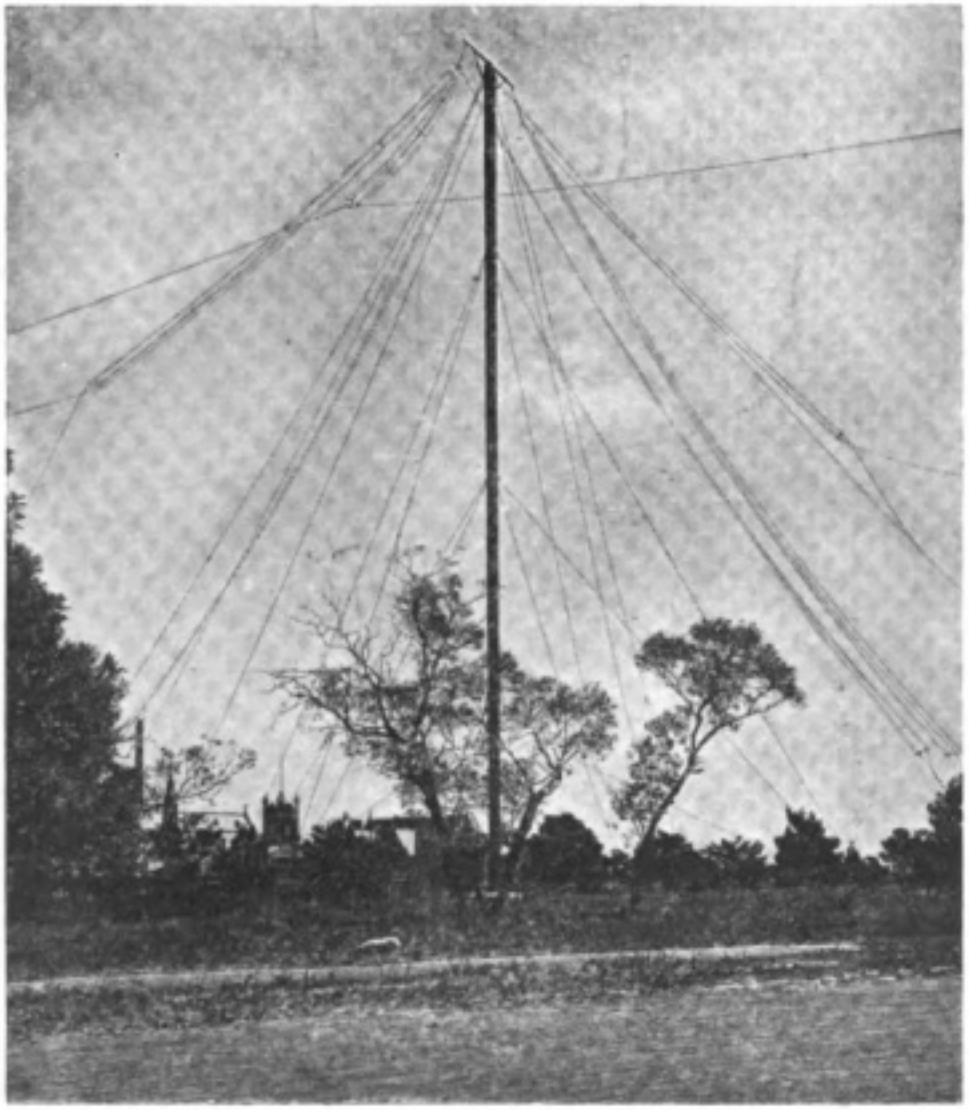
THE MAST AND AERIALS OF THE WIRELESS TELEGRAPH STATION AT BRISBANE, QUEENSLAND.

condensers discharged across a fixed spark gap through the primary of an oil-immersed oscillation transformer, the secondary of which was connected to the aerial, and to earth. The receiving apparatus included a Marconi coherer receiver and a Marconi magnetic detector. The aerials were slung between two masts at a height of about 180 ft. above the ground. The apparatus used was British-made throughout.

For many years the masts at Point Lonsdale formed a landmark for mariners entering Port Phillip, and the fact of their disappearance in the year 1912 was immediately noted by captains of Australian ships.

Both stations have now been removed, and no better tribute could be paid to British workmanship than exists in the fact that—after standing idle and unattended for several years—this apparatus was found in excellent condition, and some of it is actually in use at the present day at two stations within the tropics.

Before the year 1910, wireless communication in Australasia was practically confined to H.M. warships. An occasional mail steamer arrived with a Marconi equipment, but the P. & O. and Orient Lines initiated its application to regular trading vessels in 1910 and 1911. At that time there were no shore stations for communicating with ships, but the Marconi Company arranged a regular service of watches for vessels lying in port to provide communication with vessels approaching and leaving the Australian coast. This proved so successful that ships lying at Circular Quay in Sydney exchanged messages with vessels out in the Australian Bight, over 800 miles distant. Numerous official and private messages were received in this way at the several ports and handed in at the local telegraph offices for transmission to their destination.

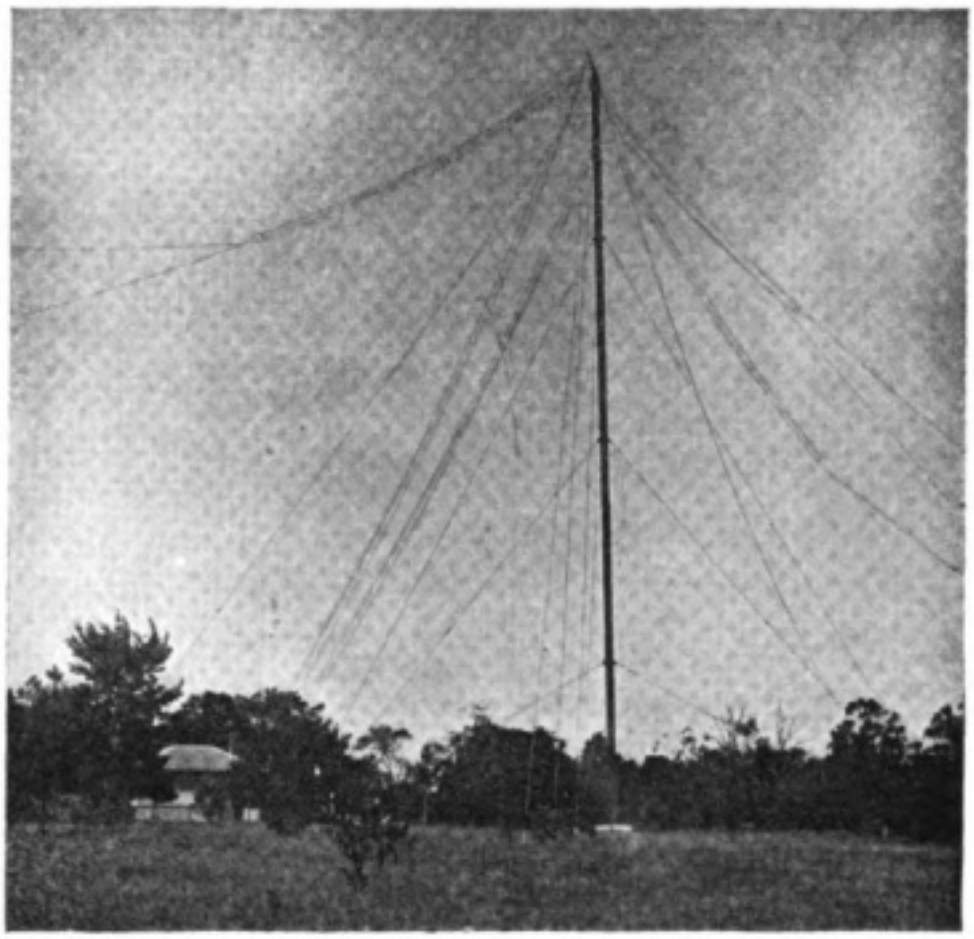


GENERAL VIEW OF THE ANTENNA AT THE MELBOURNE RADIO STATION TAKEN FROM THE NORTH-NORTH-EAST.

The first commercial shore stations were erected in the Fiji Islands by the Marconi Company. These comprised a five-kilowatt plant at Suva and 1½-kilowatt stations at Labasa and Taviun

respectively: they were opened for traffic in 1911. Shortly afterwards a small temporary station for communication with ships at sea was erected at the Hotel Australia, in Sydney, and a similar temporary station on the General Post Office in Wellington.

From that time steady progress was made up to the outbreak of the great world war, when there were seventeen low power and two medium power stations in Australia, two low power and two medium power stations in New Zealand, and low power stations in Fiji, at Chatham and Macquarie Islands, and in British New Guinea. In Australia, stations for ship-to-shore communication exist in the vicinity of the chief port of each State—viz., Melbourne, Sydney, Perth, Adelaide, Brisbane, and Hobart, and intermediate stations are in operation at other points round the coast of the island continent. These stations have a normal range of 300 to 450 miles.



VIEW OF MELBOURNE WIRELESS STATION AERIALS TAKEN FROM THE WEST.

The New Zealand stations are situated at Awanui, near Doubtless Bay, in the extreme north, at Awarua, near Invercargill, in the extreme south, on the Post Office Building at Auckland, and on Tinakori Hills near Wellington. This system will probably be supplemented in the near future by the erection of low power stations at important points, such as Hawkes Bay, Christchurch (or Lyttelton), and Westport. The New Zealand low power stations possess slightly less power than the Australian stations, and their normal daylight range for communicating with ships is about 300 miles.

In addition to its chain of coastal stations the Australian Government has opened stations at Port Moresby in New Guinea and at Thursday Island. The New Zealand Government also operates the small station on Chatham Island, and until the present year both Governments operated conjointly the station on Macquarie Island, which was orginally erected by the Mawson Antarctic Expedition. All these stations are chiefly designed and used for communication with ships at sea at distances up to 450 miles.

The medium power stations, however, have greater ranges available for special work, but this was seldom made use of in normal times. When working at full power direct communication can be maintained between Sydney and Awanui (N.Z.),

but these stations are not equipped for high-speed working and consequently could not exchange heavy traffic. Commercial traffic was only passed between them at the Christmas and New Year seasons, when the Governments made a feature of the public exchange of greetings between residents of the two countries.

Commercial traffic is exchanged between Australia and New Guinea *via* Townsville, Thursday Island, and Port Moresby. This traffic is steadily increasing, and will probably lead to the use of automatic transmitting and receiving apparatus in the near future.

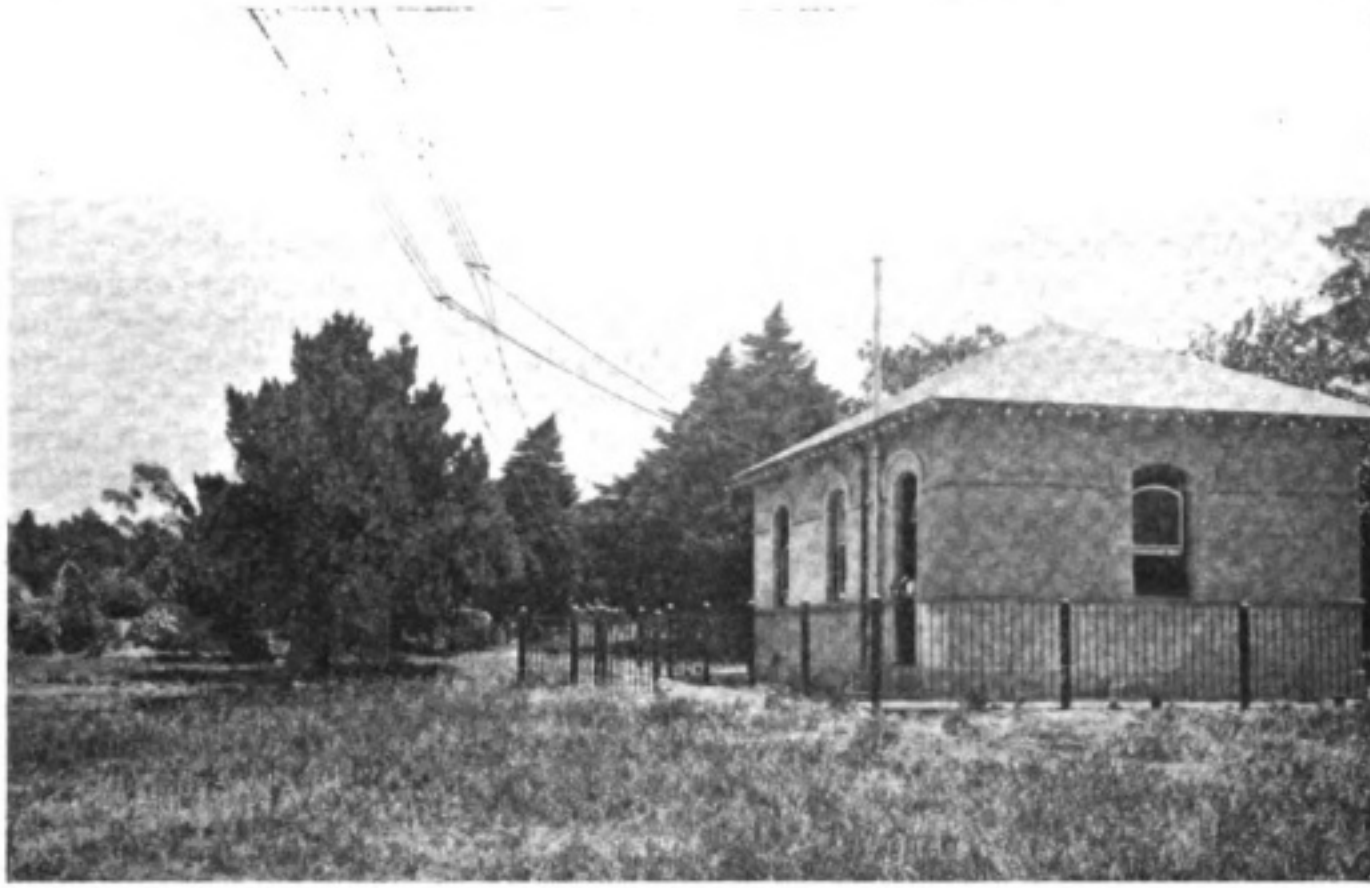
An interesting feature of wireless communication in Australasia is the exceptionally long range of communication obtainable during the hours of darkness. Merchant ships and low power shore stations communicate frequently at distances over two thousand miles, and distances of 1,500 miles are commonplace occurrences. This fact, which is entirely due to natural and not to human agency, leads to a certain amount of friendly rivalry between operators and others responsible for the various stations; it also tends to give the layman an erroneous idea that communication over long distances can be "maintained" by low power stations. For an explanation of this phenomenon we must await the compilation of much more data than is yet available, and a more complete investigation of long distance transmission phenomena.

[Photo by] [Hall & Co., Sydney.

EXHIBITION OF WIRELESS TELEGRAPH APPARATUS AT THE TRADE FAIR HELD AT SYDNEY IN OCTOBER, 1915.

Prior to August, 1914, much Teutonic energy was devoted to the erection of wireless telegraphic stations in the late German possessions in the Pacific Ocean. Long-range stations were erected in German Samoa, Caroline Islands, and New Guinea, all of which have since been captured by the Australian and New Zealand forces.

Not the least among the wireless developments in and around Australasia was the establishment of a station on the Antarctic continent by



VIEW OF LOWER PORTION OF ANTENNA AT MELBOURNE WIRELESS STATION TAKEN FROM THE EAST.

Sir Douglas Mawson's expedition in 1912. This station, which was erected and manned by Australians who had been trained by the Australian Wireless Company, provided a link between the marooned explorers and the outer world for more than twelve months. Through it the adventures of Mawson and his comrades were made known to the world, the explorers received news of outside happenings almost daily through the long winter of darkness, and published a small journal entitled *The Blizzard*. The party also made regular meteorological observations which were transmitted daily to Australia and New Zealand. These wireless reports from the land of ice proved most valuable to the meteorologists of both countries. A startling illustration of the connection between Antarctic and Australian weather conditions was provided when on the day following a severe gale with heavy rains in New South Wales the newspapers published a message from Dr. Mawson in which he asked how Australians had enjoyed the rough weather he had "sent up."

All wireless land stations in Australasia are Government-owned. In Australia they are controlled by the Department of the Navy under the direction of Engineer-Lieutenant F. G. Cresswell. The New Zealand stations are controlled by the Post and Telegraph Department, and are chiefly superintended by Mr. T. Buckley, Chief Electrician for that Department. In Fiji the Superintendent of Telegraphs, Mr. C. C. F. Monckton, looks after the wireless service as well as the inland telegraph and telephone systems. These departments work in close co-operation with Amalgamated Wireless (Australasia), Limited, which owns the patent rights of the leading systems, operates all merchant ship stations, and manufactures wireless telegraphic apparatus for all purposes.

Compulsory Wireless

THE following appeared in the *London Gazette* under the date of July 28th, 1916:

"After regulation 37A* the following regulation shall be inserted:

"37B (1) Every British ship of three thousand tons gross tonnage or upwards, "in respect of which a licence to instal wireless telegraph apparatus has been granted "by the Postmaster-General, and which puts to sea from a port in the United "Kingdom after a date to be specified in such a licence, shall be provided with a "wireless telegraph installation, and shall maintain a wireless telegraph service, "and shall be provided with a certified operator, together with suitable accom- "modation for the apparatus and operator:

"Provided that where a licence has been granted in respect of a ship before "the making of this regulation, this obligation shall apply as if the twenty-first "day of August, nineteen hundred and sixteen, were the date specified in the "licence.

"(2) Application to the Postmaster-General in a form prescribed by him for "such a licence shall, unless a licence has before the making of this regulation been "granted in respect of the ship, be made:

"(A) In the case of a ship of such tonnage as aforesaid, registered in the United "Kingdom, by the owner thereof on or before the twenty-first day of August, "nineteen hundred and sixteen; and

"(B) In the case of a British ship of such tonnage as aforesaid, registered "elsewhere than in the United Kingdom, by the master of the ship within two "days from the arrival of the ship in the United Kingdom next after the making "of this regulation.

"(3) The Postmaster-General shall, as and when wireless telegraph apparatus "and the service of operators become available for the purpose, cause licences to "be issued in respect of such ship as in the opinion of the Admiralty should in the "national interests be fitted with such apparatus, and the licences shall specify "the date as from which the carrying of such apparatus under this regulation is "to be compulsory, the character of the apparatus, and the qualifications of the "operator.

"(4) The Postmaster-General may

"(A) Extend the time mentioned in the licence as the time within which any "apparatus is to be provided; and

"(B) Exempt any ship from the obligations imposed by this regulation.

"(5) If the provisions of this regulation or the terms of any licence granted "thereunder are not complied with in the case of any ship, the master or owner "of the ship shall be guilty of a summary offence against these regulations, and if "any master or owner fails to make an application in accordance with this regulation "he shall be guilty of a summary offence against these regulations, and in either "case if the ship is at any time subsequently found at a port of or within the terri- "torial waters adjoining the United Kingdom the ship may be seized and detained.

"(6) In this regulation expressions have the same meaning as in the Merchant "Shipping Acts, 1894 to 1914."

The above regulation expresses in official language the fact that the owners of every vessel of 3,000 tons or over registered at a British port in the United Kingdom must take out a licence for a wireless installation before August 21st, 1916, irrespective

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* A regulation providing that every British vessel of 500 tons burden or over shall be furnished with suitable hand flags for signalling by day, and efficient flash-lamps to carry three miles in clear weather for signalling by night.

of whether it carries passengers or not. Moreover, the owners of any British vessel of other registration must apply for such a licence within two days of its arrival at a port in the United Kingdom. In order to meet the possibility that there might not be enough apparatus and operators to go round if all vessels at present unprovided were to be fitted at once, it will be seen that Clause 3 provides that the Admiralty should specify at what date vessels are to be fitted and that the dates so specified are to be inserted on the licences granted by the Postmaster-General. The latter has also the option of extending the time, or even of granting total exemption.

The "Safety of Life at Sea Convention" of 1912, to which the British Government gave their adhesion, has already embodied official recognition of the importance of wireless to ships at sea. A vast increase in the number of mercantile vessels equipped and in the shore stations opened for their benefit was the immediate result of its adoption. But up to the time of the outbreak of war it had not been found possible to carry out its provisions entirely, especially with regard to freight steamers, and it has been left for the stress of war to emphasise the equal necessity for freight steamers as well as passenger steamers to carry this all-important safeguarding equipment. Our enemies are straining every effort to prevent foodstuffs, supplies and other stores from reaching our island, and it is their action that has resulted in the British Government following the lead set them some time ago not only by the United States of America, but also by quite small republics like Uruguay.

An Automatic Electric Generating Plant for Emergency Use

MESSRS. R. A. LISTER & CO., LTD., of 47 Victoria Street, Westminster, have just placed on the market a highly interesting emergency generator with auxiliary apparatus under the title of the "SOS type, Lister-Bruston Patent Automatic Electric "Generating Plant," for use on board ship to supply current to the wireless and other apparatus when the ship's main dynamos are out of action. This plant contains a number of ingenious and useful features, some of which are the following:

(1) The auxiliary plant starts immediately the main supply fails.

(2) The plant is so designed that immediately the voltage of the ship's main supply falls below a predetermined point, the plant automatically starts up. On the other hand, the plant may be started by the operator or any other authorised person by pressing the push.

(3) It is self-regulating, adjusting itself to the load and maintaining a constant voltage.

(4) To ensure that the auxiliary plant is always kept in good working order, it is arranged that it shall automatically start up and stop at any predetermined time daily.

(5) Provision is made on the switchboard for charging in cells which may be required in connection with the apparatus.

For further particulars readers should apply to Messrs. Lister, at the above-named address.

NOTES OF THE MONTH

WILL the Secretaries of all amateur societies which have not been suspended owing to the present war kindly forward full particulars of their societies to the Editor, in order that suitable notice may be inserted in the 1917 edition of the *Year Book of Wireless Telegraphy and Telephony*?

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The vagaries of public opinion are really remarkable! When Nature does not seem to be following her usual course all sorts of "explanations" are offered by those who know least about the subject. Thus, when the Marconi wireless station was established at Brow Head, the very wet summer season of that year was ascribed to the disturbance in the atmosphere caused by the emission of the ether waves. The latest assertion on these lines is that the bad weather of the current year is due to the altered direction of the Gulf Stream, which, it is now reported by captains, has turned westward.

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We would call the attention of our readers to the notice which appears on our contents page to the effect that many of the original drawings from which the illustrations in this and back numbers of our magazine are reproduced are for sale. We have been approached by several readers as to whether these drawings are available. Most of them are for sale, and if any reader desires one or more we shall be pleased to let him have any that are available.

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Our readers will recollect that, a year or two ago, a wireless installation was erected at St. Kilda, the lonely Atlantic island which lies many miles to the west of the Hebrides. Thus by this up-to-date method of communication the inhabitants of the island, who number seventy, have been receiving a constant supply of war news. It is interesting to note that there have been during the past year two births and three marriages in the island.

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We are glad to notice that, unless cause to the contrary be shown before October 14th next, the Anglo-German Wireless Syndicate is to be struck off the Register of Joint Stock Companies. The sooner all trace of any enemy influence is eliminated in this country the better.

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Among the members of the United British Industries Association we find the names of Marconi's Wireless Telegraph Company, Limited, and the Marconi International Marine Communication Co., Ltd. The Association has been formed amongst business concerns, in order that they may combine on a national basis to meet the competition of other countries after the war.

Maritime Wireless Telegraphy

Long-Distance Records.

Two further instances of long-distance records have recently been reported from the Pacific Ocean. The s.s. *China*, belonging to the China Mail Steamship Company, was in communication with the Marconi station at Hillcrest, California, from the day she left San Francisco until she was 2,800 miles away from that port. A similar occurrence was recorded by the steamship *J. A. Moffett* returning from the Orient to San Francisco. At 2,600 miles from that port, the night operator at Hillcrest picked her up. It is interesting to notice that both steamers are equipped with the new Marconi quenched-gap sets.

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A Disaster to the "Roanoke."

A sad tragedy of the sea recently and dramatically came to light. One morning a small ship's boat arrived at San Luis Obispo containing three men, the only survivors of the steamship *Roanoke*. She left San Francisco at midnight on May 8th bound for Valparaiso, and laden with a cargo of dynamite, wheat and oil. The next morning the *Roanoke* sighted a yacht, whose captain advised the *Roanoke* that a heavy sea was running, and that the wind was blowing at the rate of 20 miles an hour. Several wireless messages were received from the vessel after this, the last one giving her position as 90 miles south of San Francisco. From that time until the arrival of the small boat at San Luis Obispo nothing further was heard of her. Several statements have been made as to the way in which the vessel met her doom. The most reliable records that the ship began to list heavily several hours before she sank, and preparations were made to take to the lifeboats. Of these several were swamped with the heavy sea, and others caught in the davits as they were being lowered to the water. Immediately on the arrival of the small boat at San Luis Obispo, instructions were flashed by wireless from all the coast stations to ships at sea to search for additional boats and wreckage. This course, however, produced no result, so that we are reluctantly compelled to acknowledge that the whole of the crew met their death with the exception of the three men who made their way into San Luis Obispo.

A New Steamer.

A new type of vessel has just arrived at New York from Italy. She is the new bulk cargo steamer *Milazzo*, belonging to the Navigazione Generale Italiana. She is of more than usual interest in view of the fact that she is the first of a new type of vessel, specially designed for the rapid handling of bulk cargoes, such as grain, coal, etc. Her gross registered tonnage is 11,477, whilst her dead-weight capacity is 14,240 tons. Needless to say the vessel is fitted with wireless telegraphy.

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A Youthful Scapegrace.

A sixteen-year-old adventurer of the United States recently had his dreams of a seafaring career cut short by wireless. For a long time it had been the boy's desire to go to sea, but on account of the European war his parents objected. Their consent, however, was given for him to take a cruise to the West Indies. The youngster shipped on the s.s. *Snowden Range*, but instead of going to southern waters his father learned that she was bound for Glasgow. He, therefore, sent a wireless to the captain, and the youth was taken off the ship at a subsequent port.

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Greek Steamer Founders.

The Cape Palos wireless station recently received a wireless message announcing the sinking of the Greek steamer *Nitsa*, which took place three miles north-east of Ormigas, in Spain. It transpires that she was torpedoed off Cape Palos, but fortunately the crew were saved by the Spanish steamer *Albal*.

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Naval Collier Sinks.

The United States naval collier *Hector*, bound from Newport News to Guantanamo, Cuba, sent a wireless message recently that she was aground and breaking up ten miles from Charleston. The tug *Vigilant* subsequently reported that the *Hector* had sunk, and that only the superstructure remained above water.

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A Dardanelles Occurrence.

There has just come to light knowledge of the fact that, whilst the capable band of doctors and ambulance workers were proceeding to Serbia to aid that typhus-stricken country, a wireless message was received by the steamer on which they were travelling urgently requesting them to proceed instead to Malta, where a large body of our own wounded from the Dardanelles was in dire need of surgical and medical aid. Needless to say the ship was immediately headed for the island, and the work done there by the little band was enthusiastically praised by the Governor.

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Passenger Steamer Sunk.

A wireless telegram was received at The Hague from the Zeeland Steamship Company's vessel *Koningin Wilhelmina* stating that she had struck a mine in the neighbourhood of the Noordhinder Lightship, and that she was sinking rapidly. No subsequent message was received from her, and, as we know, she quickly settled down and disappeared beneath the waves. No passengers' lives were lost, but unfortunately three members of the crew perished. The *Koningin Wilhelmina* was a paddle ship of 1,964 tons gross, and on the voyage in question had 41 passengers and a crew of 60 aboard.

The Wireless Transmission of Photographs

By MARCUS J. MARTIN.

In a series of articles recently contributed to this journal * the writer, in the space at his disposal, endeavoured to give as comprehensive a description as possible of the various methods that have been worked out for the wireless transmission of photographs. It was, of course, impossible to deal exhaustively with the subject, and the present article has been prepared with the idea of supplying more detailed information upon a point that of necessity was insufficiently dealt with in the first instance.

No apology will therefore be offered for introducing into these pages matter that is not strictly related to wireless work, and while these articles have mainly been prepared for those who are, or who are thinking of, experimenting in radio-photography, yet it is hoped that the information they contain will prove of interest and help to all those who are engaged in other branches of experimental wireless work.

To those who intend seriously to tackle the problem of the electrical transmission of photographs, either by wireless or over metallic conductors, two sets of apparatus will be necessary—one at the transmitting and one at the receiving station. In the volume already referred to several types of machines are described, each suitable for the various methods of transmitting and receiving with which they are used. An improved machine, designed and used by the writer for experimental work in connection with photo-telegraphy, is briefly described on page 20 and illustrated in Figs. 10 and 10*a*.

As at present there are no machines of any description on the market, and as the necessary information regarding their construction is not easily obtainable, the writer has prepared a constructional article with full working drawings of his experimental machine, so that the would-be experimenter will have no difficulty in getting his machines made, or, if he possesses the necessary knowledge and skill, in building them himself. This article will shortly be published in the well-known journal *Work*.

In almost every photographic method of receiving that is described the Nernst lamp is invariably mentioned as the source of illumination. Since the advent of the high-voltage metal-filament lamps the Nernst lamp has fallen somewhat into disuse for commercial purposes, but it possesses certain characteristics that render it eminently suitable for the purpose under discussion. To those who are not familiar with the working of these lamps the following notes, together with the diagram Fig. 1, will help to explain matters.

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* See The Wireless World, Nos. 22 to 28, 1915. These articles have since been amplified and published in book form, *The Wireless Transmission of Photographs*, 2s. 6d. net. The Wireless Press, Ltd.

Nernst lamps are made in two sizes, the larger being intended for the same work as usually done by arc lamps and the smaller to replace incandescent lamps. The smaller type is made to fit into the ordinary bayonet lampholders. The principal parts of the smaller type of lamp, as shown in Fig. 1, are the filament, the heater, the resistance, and the automatic cut-out. The current enters at the positive terminal, passes through the heater M, and out through the negative terminal. The filament B, which consists of a short length of an infusible earth made of the oxides of several rare minerals, of which zirconia is one, is a non-conductor at first, but becomes a conductor upon being raised to a high temperature by means of the heater M. As soon as the filament becomes conductive the current then passes through the automatic cut-out H, and the armature D is attracted, thus breaking the heater circuit. The current then flows from the positive terminal through the cut-out H, resistance J, and filament B, and from thence out of the lamp. These lamps burn in air and emit a brilliant light of high actinic power, the intrinsic brilliancy (c.p./square inch) varying from 1,000 to 2,500, as compared with 1,000 to 1,200 for ordinary metal-filament lamps.

Either direct or alternating current can be used with these lamps, and with direct current the polarity must be strictly observed, and that the positive wire is connected to the positive and the negative wire to the negative terminal. Once the lamp has been correctly placed in its holder it is essential that it should not be turned, as a change in the direction of the current will rapidly destroy the filament. The burner is very fragile, and should never be handled except by the porcelain plate P.

Care must also be taken to see that the voltage required by the burner and resistance equals the voltage of the supply circuit, and that only parts of the same amperage are used together on the same lamp. No advantage is obtained by overrunning a Nernst lamp, this only shortening its life without increasing the light. Under normal conditions the average life of the burner is about 700 hours.

The efficiency of the Nernst lamp is fairly high, being only 1·45 to 1·75 watts per c.p. The light given is remarkably steady, and the lamps are adaptable for all voltages from 100 to 300. The chief advantage of the Nernst lamp from a photographic point of view lies in the fact that it produces abundantly the blue and violet rays which have the greatest chemical effect upon a photographic film. These rays are known as chemical, or actinic, rays, and are only slightly produced in some types of incandescent electric lamps. Carbon-filament lamps are very poor in this respect.

It must by no means be assumed that because a light is visually brilliant it is the best to use for purposes of photography; and this is a point over which many photographers stumble when using artificial light. Many lights, while excellent for illuminating purposes, have very low actinic powers, while others may have low illuminating but high actinic powers. A lamp giving a light yellowish in colour usually has low actinic power, while all those lamps giving a soft white light are generally found to be highly actinic.

In addition to the actinic value of the source of illumination, the photographic film used must be very carefully chosen, as the chemical inertia of the sensitised film plays an important part in the successful reproduction of the picture. The

length of exposure, the amount of light admitted to the film, and the characteristics of the film itself are all factors which have a decided bearing upon the quality of the results obtained, and the film found to be the most suitable in one case will perhaps give very unsatisfactory results in another.

In photo-telegraphy the length of exposure is determined by the time taken by the transmitting stylus to trace over a conducting strip on the metal print, and this time, of course, varies with the density of the image and also with the speed of transmission.

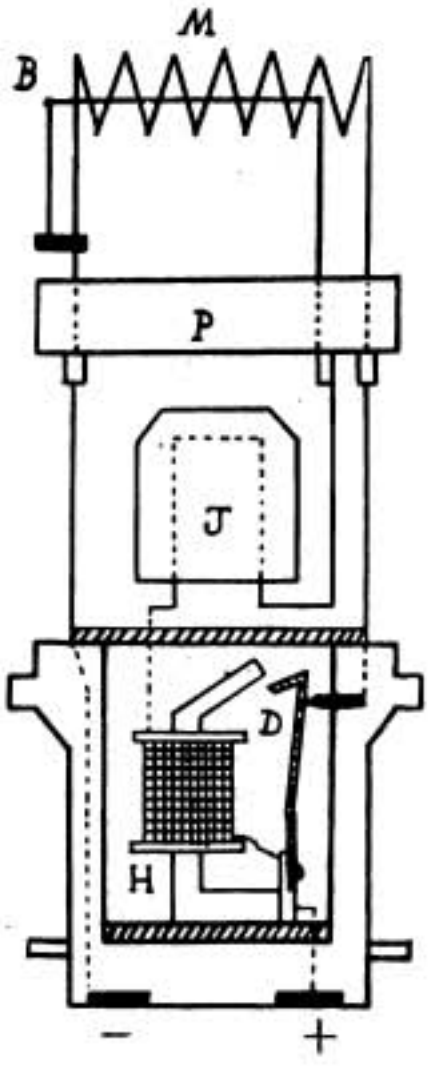
The film in ordinary photography is chosen with regard to the subject and the existing light conditions, and the amount of light admitted to the film and the length of exposure are regulated accordingly. No such latitude is, however, possible in photo-telegraphy. With each set of apparatus the various factors, such as the light value, the amount of light admitted to the film, and the length of exposure will be practically fixed quantities, and the film that will give the most satisfactory results under these fixed conditions can only be found by the rough-and-ready method of "trial and error."

The films in common use are manufactured in four qualities—namely, ordinary, studio, rapid, and extra rapid. These terms should really relate to the light sensitiveness of the film (or, as it is termed technically, the speed), but at the best they are a rough and very unsatisfactory guide, for the reason that some unscrupulous makers, purely for business purposes, do not hesitate to label their films and plates as slow, rapid, etc., without troubling to make any tests for correct classification.

The speed of photographic films or plates is indicated by a number, and the system of standardisation adopted by the majority of makers in this country is that originated by Messrs. Hurter & Driffield, abbreviated H. & D. In their system the speed of the film and the exposure varies in geometrical proportion, a film marked H. & D. 50 requiring double the exposure of one marked H. & D. 100. The highest number always denotes the highest speed, and the exposure varies inversely with the speed.

Although theoretically the higher the speed of the film the less the duration of the exposure required, there is a practical limit, as besides the intensity and actinic value of the light admitted to the film a definite time is necessary for it to overcome the chemical inertia of the sensitised coating and produce a useful effect. With every make of film it is possible to give so short an exposure that although light does fall upon the film it does no work at all—in other words, we can say that there is a minimum amount of light action for every film, and anything below this is of no use. The exposure that enables the smallest amount of light action to take place is termed the limit of the smallest useful exposure.

There is also a maximum exposure in which the



light affects practically all the silver in the film, and any increased light action has no increased effect. This is the limit of the greatest useful exposure.

In photo-telegraphy the duration of exposure, as already pointed out, is determined by certain conditions connected with the transmitting apparatus, and with conditions similar to those mentioned on page 75 the length of exposure will vary roughly from 1–50th to 1–150th of a second. The most suitable film to use would therefore be one in which these exposures come well within the limits of the film.

Another point, often puzzling to the beginner, and which increases the difficulty of choosing a suitable make of film, is that, although one make of film marked H. & D. 100 will give good results, another make, also marked H. & D. 100, will give very poor results. This is owing, not to a poor-quality film, as many suppose, but to the almost insurmountable difficulty of makers being able to employ exactly the same standard of light for testing purposes, so that although various makes may all be standardised by the H. & D. method, films bearing the same speed number may vary in their actual speed by as much as 30 to 50 per cent.

That make of film having the slowest permissible speed should be employed, as with the very high-speeded films there are greatly increased difficulties in connection with developing and handling.

The New Morse Code Card

THE new method of learning the Morse code, described and explained on the card entitled "Morse Made Easy," to which we made reference on page 300 of our July number, has evoked a considerable amount of interest, and is being welcomed in many quarters as by far the easiest method of memorising this useful code. Many students of signalling, wireless and otherwise, are using the new card for learning the code in odd moments, such as while travelling on the train, tube, 'bus and tram. Copies of the card can be obtained from the railway bookstalls and through the trade generally at the price of 3d., or 3½d. post free from the publishers, The Wireless Press, Ltd., Marconi House, Strand, W.C. Be sure to ask for "Morse Made Easy."

Manchester School of Technology

WE have just received the prospectus of the University courses in the Manchester Municipal School of Technology for the Session 1916–17. As usual, the up-to-date and progressive school authorities have arranged for the inclusion of a course of Wireless Telegraphy. The curriculum includes linear oscillators, directive radiation, measurements of current wave-length and frequency, spark frequency, logarithmic decrement, detectors, coherers, and valves. In fact, the subject is thoroughly expounded by that able professor, Mr. Bertram Hoyle, who, it will be remembered, contributed an article to our magazine last September.

Among the Operators

AN interesting event in the world of wireless took place on July 14th, when Mr. Godfrey C. Isaacs, Managing Director of the Marconi International Marine Communication Co., Ltd., invited twenty-two Marconi operators to dine with him at the Trocadero Restaurant. The twenty-two were all men who had operated the wireless instruments under conditions of great peril, and in many respects the gathering was an unique one. Of course, all the heroes of the wireless service were not present, for many of them are at sea "carrying on" and helping to safeguard the mercantile marine; but all those who happened to be ashore at the time were able to attend, and made a brave array. The names of the guests and the ships on which they had served were as follows :—

HAROLD BRIDE (s.s. *Titanic*).

WALTER CONDON (s.s. *Minnehaha*, on which ship an explosion from bombs caused a fire).

OWEN CHICK (s.s. *San Melito*, which was bombarded by a German submarine and managed to escape).

PERCIVAL DENNISON (s.s. *Den of Crombie*, torpedoed by the Germans).

EDWARD DYER (H.M. transport *Royal Edward*, which was torpedoed in the Mediterranean).

F. L. FENN (s.s. *Harmatris*).

H. JONES (the ill-fated s.s. *Hesperian*).

R. JONES (the same vessel, and later the s.s. *Appam*).

JOHN KEIR (the transport *Royal Edward*).

R. A. C. LEE (the torpedoed *Vandyck*).

R. LEITH (s.s. *Lusitania*).

D. MCCORMICK (the same ship).

J. MAURICE (s.s. *Dakir*, which caught fire and was abandoned).

R. F. MCLENNAN (s.s. *Flamenco*, sunk by the German raider *Moewe*).

P. MORRIS (torpedoed *Iberian*).

H. H. MILLS (torpedoed *Anglo Columbian*).

R. C. OLDER (torpedoed s.s. *Goldmouth*).

J. R. OLIVER (torpedoed s.s. *Norseman*).

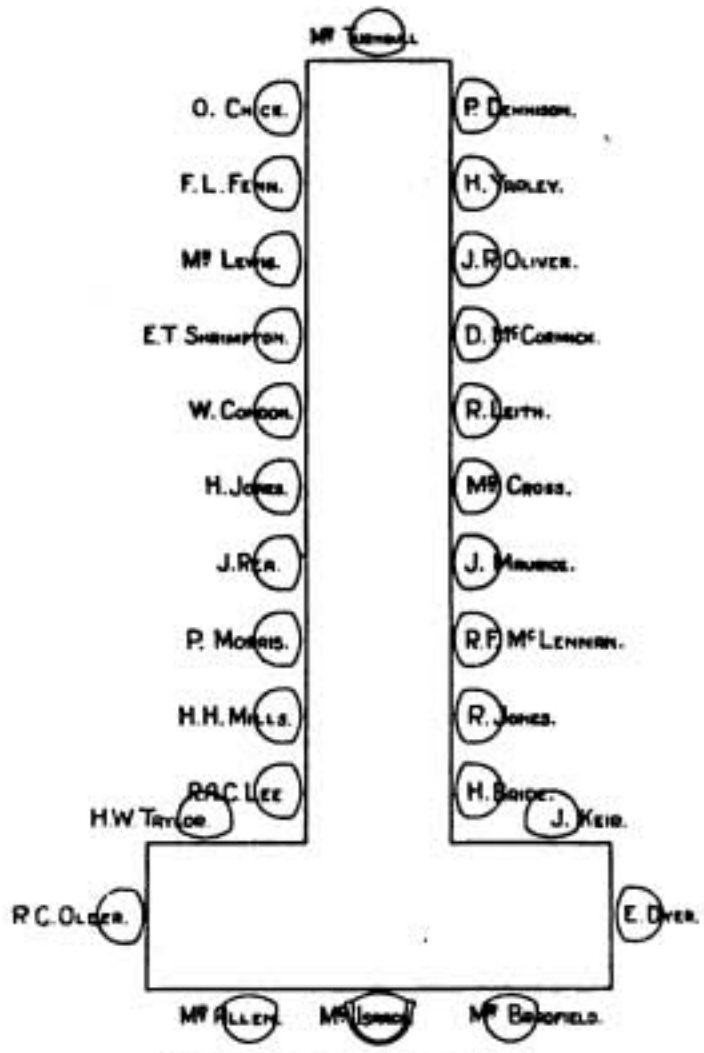
J. REA (s.s. *Anglo Californian*, shelled by a German submarine).

E. T. SHRIMPTON (the wrecked s.s. *Cobequid*, the s.s. *Kaipara* and the torpedoed s.s. *Drumcree*).

H. W. TAYLOR (torpedoed *Marquette*).

H. VARLEY (torpedoed *Simla*).

Fuller particulars of these men have already appeared in THE WIRELESS WORLD, but we would recall here that Mr. Dyer was so badly injured that his leg had to be amputated. He has not yet fully recovered. Mr. Older lost his foot owing to injuries received. Mr. Fenn received slight injuries to his leg and Mr. Shrimpton was wounded in the head. Mr. Keir was also badly bruised and cut. Some of the men have been appointed to positions ashore and others are still serving on the marine staff.



PLAN OF DINING TABLE.

Mr. Isaacs, presiding, spoke of his appreciation of the work performed and the pleasure he felt in dining with men who had so conspicuously upheld British traditions. On his right and left sat Mr. W. W. Bradfield, Manager of the Marconi International Marine Communication Co., Ltd., and Mr. H. W. Allen, the Secretary and Deputy Manager. Mr. G. E. Turnbull, Assistant Manager, and Mr. W. R. Cross and Mr. J. Lewis, Traffic Manager and Assistant Traffic Manager respectively, were also present, and did their utmost, very successfully, to make the evening an enjoyable one for the guests. Formal speeches were, of course, debarred, but among the toasts of the evening must be mentioned one by Mr. R. Jones to "Our Brothers on the Sea."

After dinner, the party proceeded to the Coliseum, occupying the Royal and adjacent boxes, to witness an excellent variety programme. The whole evening passed off most successfully and was but one more instance of the interest taken by the Marconi Company in the welfare of its employees.

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On page 463 readers will find reference to the disaster which overtook the United States steamer *Roanoke* off the Californian coast in May last. We regret to state that Operator George Ernest Chamberlain was amongst those who met his death. Like others in the service who have died in brave performance of their duties, he left behind him fine memories of courage and skill. Chamberlain was assigned to the *Roanoke* in April last, when she touched San Diego, California, on her last northbound voyage. None of the reports throw any light upon the way that Chamberlain met his death. The *Roanoke* was the first ship to which Chamberlain had been permanently appointed, although he had previously filled several temporary vacancies created by absence of the operators on holiday. Mr. Chamberlain was a native of Sawtelle, California, and after graduating from the Commercial School of that town, he attended the Polytechnic School in Los Angeles for a year. At this place he became greatly interested in electricity, especially in wireless, and soon installed a station in his own home. It is reported that he would often sit up all night sending and receiving messages from his little room, and listening to the workings of the wireless out on the Pacific Ocean. In October, 1914, he took his examination at the Y.M.C.A. at Los Angeles for wireless service and received his licence as an operator. Later he joined the Pacific Division of the Marconi Wireless Telegraph Company of America, and as we have above stated first filled a number

of temporary appointments and then was assigned to the *Roanoke*. The late gentleman, who was but 20 years of age, was very popular in his home town, and his loss is deeply lamented by all who knew him.

OPERATOR SYDNEY GOODYEAR.

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S.S. "VIRGINIA."

Wireless operators in the mercantile marine are upholding the traditions of the Marconi Company so admirably that the recounting of their brave deeds is apt to become monotonous. One of the latest cases to come to our notice is that of the s.s. *Virginia*, on which Mr. S. Goodyear was in charge of the wireless apparatus. The following extract from a letter signed by the late Master of this ship and referring to Mr. Goodyear's services is, we think, worthy of reproduction here :—

"I always found him most attentive to his duties, steady, willing and obliging "at all times, and I have pleasure in testifying to the gallant manner in which he "stuck to his post, calling for assistance until the last moment after the vessel had "been torpedoed and was rapidly sinking."

Mr. Sydney Goodyear is 20 years old and was born in Lincolnshire. After leaving school he obtained employment on the telegraphic staff of the Great Northern Railway at Manchester. In April, 1915, he joined the London School of the Marconi Company and after a training at this place was appointed to the s.s. *Nevasa*. Later he was transferred to the *Virginia*, which was torpedoed in the middle of July of this year. He was fortunately rescued uninjured.

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CAPTURE OF THE S.S. "ESKIMO."

OPERATOR L. P. DE G. HUGO.

The capture of the Wilson liner *Eskimo* by the enemy will be well known to our readers through the notices which have appeared in the daily Press. The operator of this vessel, Mr. Leon Pierre de Graaff Hugo, who is related to the famous novelist, Victor Hugo, is of South African birth, belonging to an old Colonial family of Dutch descent. Mr. Hugo, who has lived for a number of years in England, completed his education at the Bedford Grammar School and West Ham Technical Institute. Before joining the Marconi Company he held a position in the Leytonstone Electricity Works. He received his preliminary Wireless training at the British School of Telegraphy and joined the Marconi Company's School in December,

OPERATOR S. H. SANDERS.

1914. Since that time he has served on a number of ships and was appointed to the *Eskimo* in January of this year. We sincerely hope Mr. Hugo is being well treated.

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S.S. "ALTO."

The operator on board the mined steamer *Alto* was Mr. Stanley Harold Sanders, of Ilford. Mr. Sanders, who is 23 years of age, received his preliminary wireless training at the East London Telegraph Training College, Forest Gate, and entered the Marconi Company's School in October, 1914. He was first appointed to the s.s. *Glengorm Castle*, and from this ship was transferred to the s.s. *Minnehaha*. He then sailed on the s.s. *Karonga*, *Kumara* and *Wyncote*, and was appointed to the *Alto* in March of this year. Fortunately no lives were lost in the disaster, and Mr. Sanders escaped without injury and has since been able to resume his duties on another ship.

National Physical Laboratory

IN the Physics Department of the National Physical Laboratory at Teddington the electrical standards division has been largely occupied with the investigation for the Admiralty and the War Office of some special problems in connection with wireless telegraphy. In the division for general electrical measurements a number of special questions have been investigated, and at the same time it has been found possible to continue some of the research work, which has assumed increased importance during the war.

Dr. W. H. Eccles, A.R.C.S., M.I.E.E.

WE are informed that the Executive Committee of the City and Guilds of London Institute have appointed Mr. W. Eccles, D.Sc., A.R.C.S., M.I.E.E., to the Professorship of Electrical Engineering and Applied Physics at the Institute's Technical College, Finsbury, rendered vacant by the recent death of the late Professor Silvanus P. Thompson. Dr. Eccles is at present University Reader of Graphics at University College, and is the author of a work on *Wireless Telegraphy and Telephony*, and numerous papers and inventions on subjects connected with electrical engineering. We offer him our sincere congratulations.

Wireless on the Captured "U.C. 5"

MANY professional wireless men and others interested in radio-telegraphy have paid a visit to the captured German submarine, which has been exhibited by the Admiralty at the Temple Pier, London. Although the vessel was severely damaged by the explosion which took place aboard just prior to her capture, the Admiralty have re-erected the aerial so that the public may see how the wires are arranged. The antenna, which is of the two-wire "T" type, is supported by the central mast, from which the flags can be seen suspended. A small spreader at the top holds the wires apart, the wires themselves being drawn down to the bow and stern. The arrangement of the wires and spreader forward of the mast can be well seen in the photograph, and the after wires, not so clearly shown, are arranged in a similar fashion. The down-lead to the deck insulator is taken from aft of the spreader, and is led to a flexible insulated cable, which in turn is connected to the lead-in tube. The short section of flexible cable and the lead-in tube can be seen on the bridge immediately behind the periscope. When not in use the mast, which is hinged at its base, folds down on to the after deck.

It will be seen that the aerial arrangements are neither so elaborate nor so interesting as those described and illustrated by Mr. Percival Dennison in our issue for February last. This is probably due to the fact that the *U.C.* 5 is one of the earlier types of German submarine.

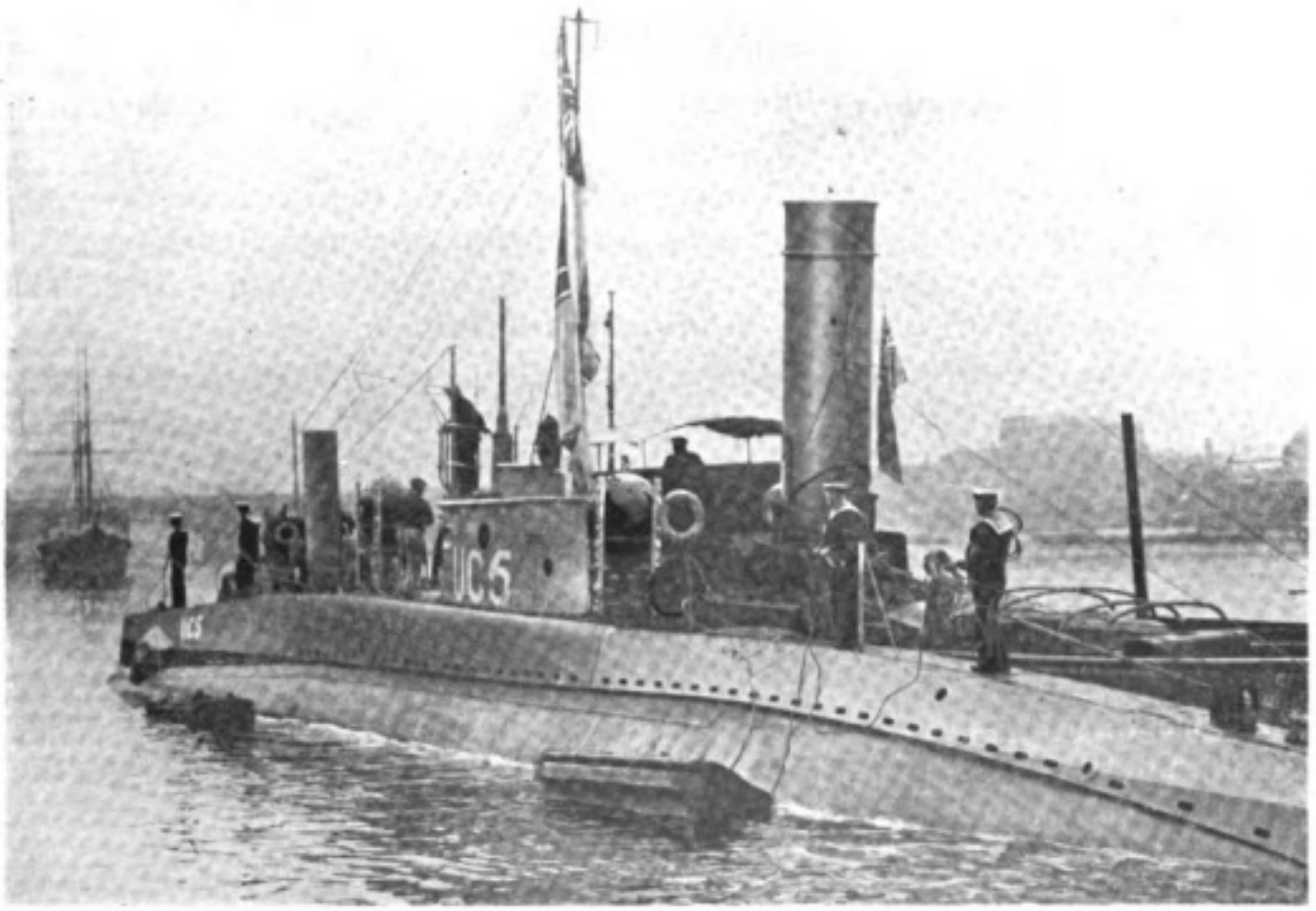

Photo by] [*Photopress.*

THE SUBMARINE MINE-LAYER BEING BERTHED AT TEMPLE PIER. H.M.S. "PRESIDENT" IN THE DISTANCE ON THE LEFT.

Wireless Telegraphy in Newfoundland

THE following report was published in the June number of the *Monthly Proceedings of the Association of Chambers of Commerce of the United Kingdom.* It is embodied in the Report of the Meeting of the Executive Council, held on 20th June, 1916 :—

" TELEGRAPHIC COMMUNICATION WITH NEWFOUNDLAND.

" The Council had this subject under consideration, and the following copy of a " Petition presented by the St. John's Newfoundland Board of Trade to the Right " Honourable Sir Edward P. Morris, P.C., Kt., K.C., LL.D., Prime Minister of New- " foundland, was read :

" PETITION

" SHOWETH

" 1. That the Marconi Wireless Telegraph Company of Canada, Limited, " inaugurated in 1907 a Wireless Telegraph Service between Newfoundland, Canada " and Great Britain, introducing rates at a considerable reduction below those charged " by the Cable interests.

" 2. That the British and Canadian Governments, realising the benefits of the " cheap and efficient telegraph facilities rendered by the Marconi Service, recognise " the Marconi Company as an International Cable Company, and have placed it on " an equal footing with all other Cable Companies.

" 3. That the Newfoundland Government has refused to entertain the repeated " requests of the Marconi Company to be granted proper through rates and facilities " on the same terms as conceded to other Cable Companies handling Telegraphic " Traffic between Newfoundland, Canada and Great Britain.

" 4. That in consequence of the refusal of the Newfoundland Government to " extend to the Marconi Company facilities usually accorded to a connecting Tele- " graph Enterprise, the Marconi Company is compelled to accept messages at " ' Domestic Rates,' thereby operating at a serious disadvantage as compared with " the competitive Cable Companies.

" 5. That in view of the actual financial loss incurred by the Marconi Company " in handling Newfoundland traffic as a result of this unfair discrimination, it has " now been practically decided to withdraw the Marconi Service from the Island, " in which event the increased charges incurred by routing messages over the Cable " Companies' systems will cause hardships to your constituents and affect the overseas " trade of the Colony.

" 6. That the contract entered into by the Government with the Commercial " Cable Company, granting special privileges to that Company, expires on the 10th " May, 1916, and that the present is an opportune moment for the Government to " remove the discrimination against the Marconi Company.

"7. Wherefore your petitioners humbly pray that the Government may be "pleased to sanction the passing of legislation:—

"(*a*) To recognise the Marconi Company as an International Cable Company "and to grant to it a 'through word rate' on all messages originating at or "destined for Newfoundland points on the same basis as the conjoint rates "rendered by the Newfoundland Postal Telegraphs, to the other competing "Cable Companies, and generally to confer upon the said Marconi Company "all the rights and privileges as the Cable Companies operating in the Island "at present enjoy.

"(*b*) To amend without delay the agreements now in force between the "Government and the Commercial Cable Company, dated 10th May, 1906, "and between the Government and the Marconi Company, dated 6th April, "1906, so that the Marconi Company shall be free to handle messages originating "outside the Colony and destined to Newfoundland points, and vice versa, by "means of its stations at Cape Ray or Cape Race and a connecting station on the "mainland of Canada.

"*1st May*, 1916.

"The Council unanimously decided to support this petition, and the following "resolution was passed for transmission to the proper quarters:

"WHEREAS a petition was presented by the Board of Trade, St. John's, New- "foundland, to the Premier and Legislature of the Colony on 1st May, 1916, praying "that the same and equal through rates and traffic facilities be accorded to the "Marconi Wireless Telegraph Company of Canada in respect of all messages "originating at and destined for places in Newfoundland as are granted generally to "other competing telegraphic interests, and

"WHEREAS the Association is informed that the Marconi Wireless Telegraph "Company of Canada has hitherto by reason of prohibitive rates carried messages "from Newfoundland at a loss, and finds it necessary to withdraw from telegraphic "business with the Colony, unless such through rates and traffic facilities are granted, "and

"WHEREAS representations have been made by merchants and Chambers of "Commerce in the United Kingdom in favour of the granting of such through rates "and traffic facilities and the encouragement of undertakings reducing telegraphic "charges,

"RESOLVED that this Council urges the Government of Newfoundland to grant "such through rates and traffic facilities to the Marconi Wireless Telegraph Company "of Canada, and generally to any other British telegraphic undertakings as are "granted to any other telegraphic undertakings in the Colony, and considers that "it is desirable from a commercial and imperial point of view that every step be "taken to secure reductions of telegraph rates and to enable the commercial com- "munity to avail themselves of Trans-Atlantic and other wireless services, and "expresses the hope that the petition of St. John's Newfoundland Board of Trade "may be acceded to. Copies of this resolution to be officially forwarded to the "Premier and Government of Newfoundland, the Colonial Office, and the St. John's "Newfoundland Board of Trade."

Copies of this resolution were duly despatched to those enumerated, and on June 28th last the Premier of Newfoundland (Sir E. P. Morris) replied to Mr. R. B. Dunwoody, the energetic and courteous Secretary of the Association of Chambers of Commerce, as follows :

"*June 28th*, 1916.

"DEAR SIR,—I have to acknowledge the receipt of your communication of "June 27th covering copy of the resolutions unanimously adopted by your associa- "tion on the 20th instant. I shall take great pleasure in forwarding these to "Newfoundland for the consideration of the Government.

"I may say to you that the whole of the subject matter of the resolutions has "been for some time under the consideration of the Newfoundland Government, "and I have no doubt at a very early date a solution of the question satisfactory "to all concerned will be arrived at.

"Yours, etc.,
"E. P. MORRIS.

"R. B. Dunwoody, Esq."

It would therefore appear as if the disabilities from which the Marconi Wireless Telegraph Company of Canada has been suffering for so long a period will, in the near future, be removed.

The company, according to its usual custom, gave the merchants in Newfoundland the benefit of its cheaper Atlantic facilities, and they were thus able to exchange telegrams with their correspondents at 8d. per word for ordinary messages, 4d. per word for deferred plain language telegrams, 2s. 6d. for night letters of 13 words, and 2d. per word for each additional word beyond 13, and 4s. for week-end letters of 25 words, plus 2d. per word for each word beyond 25. The Government of Newfoundland, however, would not grant the company through rates and facilities, and all messages for transmission *via* Marconi were treated as local messages, which means that they had first to be sent as inland telegrams to the company's telegraphic address at a rate in excess of the total rate collected for transmission to London, leaving the company to pay out of their own pockets any loss incurred. This the company cheerfully did, hoping eventually to obtain proper facilities, but as no satisfaction could be obtained they were forced eventually to give notice of the withdrawal of the Marconi rates. This resulted in the strongly worded petition above referred to, and equally strong resolution of the Associated Chambers of Commerce, which do not leave any doubt of the attitude of the mercantile community of not only Newfoundland, but also of Great Britain.

It will be seen that the Association of Chambers of Commerce in their resolution take the question entirely out of the local atmosphere, and place it on an Imperial basis.

It may also be stated that the London Chamber of Commerce took independent action, and addressed various letters to Government Departments and to the St. John's Board of Trade, and the company has besides many letters from important firms showing their strong feeling in favour of the Marconi Company's transatlantic service, and their opinion that every support should be given to it. The settlement of the question now awaits the return of Sir Edward to St. John's.

Foreign Notes

CANADA.

FROM news to hand from Canada it is learnt that the New Canadian Government Railway, which is to connect Hudson Bay with the Canadian Northern Railway at Le Pas, Manitoba, will be equipped with wireless telegraphy instead of the old wire system.

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FRANCE.

The city of Lyons, in France, has made a big step forward in regard to the problem of what to do with permanently disabled soldiers after the war. It has most enterprisingly started a professional school for the wounded. When the patient leaves the doctor's hands he is passed on to the school, and the instructor there sends him back into the world with a trade in his hands and new youth in his heart. Among the subjects taught are the manufacture of toys to compete with Germany, photography, clockmaking, bookmaking, and wireless telegraphy. The latter is due to the initiative of Dr. Vigne, the new chief of the medical staff.

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GERMANY.

From a Swedish source it has recently been intimated that wireless telegraph traffic has been reopened between the United States and Germany. It had been interrupted during the past month owing to atmospheric disturbances.

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HOLLAND.

It is understood that the Government of Holland is planning to establish direct wireless communication between that country and the Dutch East Indies, in order to supplement the present cable service.

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PACIFIC.

With the satisfactory conclusion of the official tests between the high-power wireless stations at Funabashi (Japan) and Honolulu, the Trans-Pacific scheme of wireless intercommunication is now complete. M. Tanaka, Director-General of Posts and Telegraphs in Japan, has despatched to Mr. E. J. Nally, the General Manager of the Marconi Wireless Telegraph Company of America, hearty congratulations upon the results of the final tests.

The Trans-Pacific wireless service, stretching across some 6,300 miles of ocean, will be conducted between Funabashi and San Francisco, the station at Honolulu acting as a relay. The section between San Francisco has been in operation for some months; the Honolulu-Funabashi section, which has just received official approval, spans an interval hundreds of miles greater than the distance between Berlin and New York. Descriptions of the Honolulu station have already appeared in our magazine.

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PORTUGAL.

According to reports from Portugal, a scheme is afoot for the inauguration of

an extensive system of wireless telegraph stations to link Lisbon with the Portuguese colonies and other European capitals.

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SIBERIA.

The wireless station on Dickson Island was to have been dismantled, but, thanks to the timely and enlightened intervention of the Russian Naval Ministry, which is providing the necessary funds, its existence is saved, and it will be able to carry on work not only of great scientific value, but also of practical utility for Arctic navigation, which is just now of special importance for Russia. The island is at the mouth of the River Yenesei.

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UNITED STATES.

In view of the strained relations which unfortunately exist between the United States and Mexico, the former country has deemed it necessary to send out broadcast, wireless warnings to ships at sea to beware of lighthouses in Mexican waters, some of which have extinguished their usual lights. Others have been altered in order to hamper American naval operations.

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Prominent among the features of the parade of the New York Signal Corps as third line of defence for the American nation was the wireless cart of the 1st Battalion, which was offered as a gift by the Marconi Wireless Telegraph Company of America. On the sides of the cart appeared the words "1st Battalion Signal Corps, Junior American Guard." The procession also contained more mobile units of light equipment—viz., wireless pack sets. These, which were carried by members of the Signal Corps, formed a subject of considerable interest and comment among the spectators. More than a thousand members of the National Amateur Wireless Association and the Guard were in line.

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News is to hand that members of the National Amateur Wireless Association are now in summer camp at Birchwood Lake. This sheet of water nestles among the ranges of the Shawngunk Mountains in Sullivan County, New York, 1,600 feet above the level of the sea. Its location is about 100 miles from New York City. The wireless station to be operated under the auspices of this Association will be set up on a knoll near the Lake, whilst a tall pine tree will probably be used as one of the supports for the antenna. A competent wireless telegraphist will be in charge of the station and will give instruction in the science. A number of pack sets will also be provided to supplement the work of the main station. The camp will remain open until September 9th.

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According to American newspapers it is said that a powerful Government wireless station at Yerba Buena Island, near San Francisco, has picked up radio messages emanating from Germany. Pacific Coast commercial stations have also received messages from Hanover, Germany, says the Marconi operator at Point Reyes. "This is unusual," he continues, "as our station is not tuned to work with the "German stations."

Instructional Article

NEW SERIES (No. 13).

The following series, of which the article below forms the thirteenth part, is designed to provide wireless telegraphists, amateurs, and technical students generally, with clear and precise instruction in technical mathematics, in order that they may be enabled to read and understand the more advanced technical articles which appear from time to time.

Partial Fractions.

88. The operation of summing a number of algebraical fractions is perfectly simple. For example, to find the sum of the two fractions $\frac{4}{7x-9}$ and $\frac{3}{5x+6}$ we proceed exactly as with arithmetical fractions:

$$\frac{4}{7x-9}+\frac{3}{5x+6}=\frac{4(5x+6)+3(7x-9)}{(7x-9)(5x+6)}$$

The denominator of this new fraction is the L.C.M. (in this case also the product) of the denominators of the previous fractions, and each part of the numerator consists of one of the previous numerators multiplied by the number of times its respective denominator divides into the new denominator.

Multiplying out we get

$$\frac{(20x+24)+(21x-27)}{(7x-9)(5x+6)}=\frac{41x-3}{(7x-9)(5x+6)}$$

$$=\frac{41x-3}{35x^2-3x-54}$$

89. We will now endeavour to carry out the reverse operation, splitting up this fraction $\frac{41x-3}{35x^2-3x-54}$ into its two simpler or *Partial Fractions*.

As a start we factorise the denominator into the two factors $(7x-9)$ and $(5x+6)$. Each of these will now become a denominator of one of the partial fractions. It now remains to find the two corresponding numerators, and we will call them, for the present, A and B respectively.

Thus we have

$$\frac{41x-3}{35x^2-3x-54}=\frac{41x-3}{(7x-9)(5x+6)}=\frac{A}{(7x-9)}+\frac{B}{(5x+6)}$$

We next multiply both sides of the equation by $(7x-9)\,(5x+6)$, in order to clear out all the fractions. We get

$$\frac{(41x-3)\,\{(7x-9)(5x+6)\}}{(7x-9)(5x+6)}=\frac{A\,\{(7x-9)(5x+6)\}}{(7x-9)}+\frac{B\,\{(7x-9)(5x+6)\}}{(5x+6)}$$

which cancels out to

$$(41x-3)=A(5x+6)+B(7x-9)$$

Now this equation will remain true, *whatever value we give to* x, and so let us put $x=\frac{9}{7}$ (you will see the reason for this shortly), and fill in this value all along the equation.

Then
$$\left(41\times\frac{9}{7}-3\right)=A\left(5\times\frac{9}{7}+6\right)+B\left(7\times\frac{9}{7}-9\right)$$
$$\left(\frac{369}{7}-3\right)=A\left(\frac{45}{7}+6\right)+B(9-9)$$
$$\left(\frac{369}{7}-\frac{21}{7}\right)=A\left(\frac{45}{7}+\frac{42}{7}\right)+B(0)$$
$$\frac{348}{7}=A\left(\frac{87}{7}\right)$$
$$\text{or}\quad A=\frac{348}{7}\times\frac{7}{87}=\frac{348}{87}=4.$$

You will now see that the value $x=\frac{9}{7}$ was deliberately chosen so that the factor $(7x-9)$ would become zero, and we should thus, by getting rid of B, be enabled to find the value of A. In a similar manner we can put $x=-\frac{6}{5}$ (in order to get rid of A), and so find B.

Thus
$$\left\{41\times\left(-\frac{6}{5}\right)-3\right\}=A\left\{5\times\left(-\frac{6}{5}\right)+6\right\}+B\left\{7\times\left(-\frac{6}{5}\right)-9\right\}$$
$$\left(-\frac{240}{5}-\frac{15}{5}\right)=A(-6+6)+B\left(-\frac{42}{5}-\frac{45}{5}\right)$$
$$-\frac{261}{5}=A(0)+B\left(-\frac{87}{5}\right)$$
Thus
$$B=-\frac{261}{5}\times\left(-\frac{5}{87}\right)=\frac{261}{87}=3.$$

Now that we have found that $A=4$ and $B=3$, we know that
$$\frac{41x-3}{(7x-9)(5x+6)}=\frac{A}{(7x-9)}+\frac{B}{(5x+6)}$$
$$=\frac{4}{7x-9}+\frac{3}{5x+6}.\quad \textit{Ans.}$$

Example.

Resolve $\dfrac{x^2+2x+1}{(x+4)(x+3)(x-1)}$ into partial fractions.

As before $\dfrac{x^2+2x+1}{(x+4)(x+3)(x-1)}=\dfrac{A}{(x+4)}+\dfrac{B}{(x+3)}+\dfrac{C}{(x-1)}$.

Multiplying all along by $(x+4)(x+3)(x-1)$ we get
$$x^2+2x+1=A(x+3)(x-1)+B(x+4)(x-1)+C(x+4)(x+3).$$

(i.) Put $x=1$.

Then $(1+2+1)=A(1+3)(1-1)+B(1+4)(1-1)+C(1+4)(1+3)$

or $4=A(4)(0)+B(5)(0)+C(5)(4)$

$4=20C$

$C=\frac{4}{20}=\frac{1}{5}$.

(ii.) Put $x=-3$.

Then $(9-6+1)=A(-3+3)(-3-1)+B(-3+4)(-3-1)+C(-3+4)(-3+3)$

or $4=A(0)(-4)+B(1)(-4)+C(1)(0)$

$4=-4B$

$B=-1$

(iii.) Put $x=-4$.

Then $(16-8+1)=A(-4+3)(-4-1)+B(-4+4)(-4-1)+C(-4+4)(-4+3)$

or $9=A(-1)(-5)+B(0)(-5)+C(0)(-1)$

$9=5A$

$A=\frac{9}{5}$.

Ans. $\frac{A}{(x+4)}+\frac{B}{(x+3)}+\frac{C}{(x-1)}=\frac{9}{5(x+4)}-\frac{1}{(x+3)}+\frac{1}{5(x-1)}$.

90. It does not always happen that the denominator can be resolved into factors of the first degree.

Example.

Resolve $\frac{2x-7}{(x^2+3x+7)(x-5)}$ into partial fractions.

In a case of this sort we set it out as follows:

$$\frac{2x-7}{(x^2+3x+7)(x-5)}=\frac{Ax+B}{(x^2+3x+7)}+\frac{C}{(x-5)}.$$

From this, as before, we get $2x-7=(Ax+B)(x-5)+C(x^2+3x+7)$

Put $x=5$, and then $(10-7)=(5A+B)(5-5)+C(25+15+7)$

$3=(5A+B)(0)+C(47)$

Therefore $C=\frac{3}{47}$.

Now there is no value of x which will enable us to find A and B, as we cannot separate them, and so we must adopt some other method to find these two values.

We have the equation

$$2x-7=(Ax+B)(x-5)+C(x^2+3x+7).$$

Multiplying out—

$$2x-7=(Ax^2-5Ax+Bx-5B)+(Cx^2+3Cx+7C)$$

Collecting terms $2x-7=(A+C)x^2+(B-5A+3C)x+(7C-5B)$.

Now, taking this equation as it stands, we know that the value of the coefficient of x^2 on the left-hand side must equal the value of the coefficient of x^2 on the right-hand side. Now the value on the left is zero, and on the right is $(A+C)$.

Therefore $0=A+C$

or $A=-C=-\frac{3}{47}$.

Similarly the coefficients of x on each side must also "balance," and so

$2=(B-5A+3C)$

$=\left\{B-5\left(-\frac{3}{47}\right)+3\left(\frac{3}{47}\right)\right\}$

$=B+\frac{15}{47}+\frac{9}{47}=B+\frac{24}{47}$.

Therefore $B=2-\frac{24}{47}=\frac{94}{47}-\frac{24}{47}$

$=\frac{70}{47}$ or $1\frac{23}{47}$.

It would, in this case, have been simpler to have equated the *constant* terms. On the left-hand side we have -7, and on the right-hand side $(7C-5B)$.

Thus
$$-7=7C-5B$$
$$=7\times\frac{3}{47}-5B=\frac{21}{47}-5B$$
$$5B=\frac{21}{47}+7=\frac{21}{47}+\frac{329}{47}$$
$$=\frac{350}{47}$$
$$B=\frac{350}{5\times47}=\frac{70}{47}\text{ as before.}$$

Ans. $$\frac{Ax+B}{(x^2+3x+7)}+\frac{C}{(x-5)}=\frac{-\frac{3}{47}x+\frac{70}{47}}{(x^2+3x+7)}+\frac{\frac{3}{47}}{(x-5)}=\frac{70-3x}{47(x^2+3x+7)}+\frac{3}{47(x-5)}.$$

Example.

Resolve $\frac{3x^2+4x-2}{(x+1)^2(x-2)}$ into partial fractions.

In this case it is possible that we may have one partial fraction with a denominator $(x+1)^2$, and another with a denominator $(x+1)$. For this reason we set it out as follows:

$$\frac{3x^2+4x-2}{(x+1)^2(x-2)}=\frac{A}{(x+1)^2}+\frac{B}{(x+1)}+\frac{C}{(x-2)}.$$

As before, we multiply all along by $(x+1)^2(x-2)$, and so get $3x^2+4x-2=A(x-2)+B(x+1)(x-2)+C(x+1)^2$.

(i.) Put $x=2$.

Then $(12+8-2)=A(2-2)+B(2+1)(2-2)+C(2+1)^2$
$$18=A(0)+B(3)(0)+C(3)^2$$
$$=9C$$
$$\text{or } C=\frac{18}{9}=2.$$

(ii.) Put $x=-1$.

Then $(3-4\cdot2)=A(-1-2)+B(-1+1)(-1-2)+C(-1+1)^2$
$$-3=A(-3)+B(0)(-3)+C(0)^2$$
$$=-3A$$
$$\text{or } A=1.$$

Equating the coefficients of x^2, we get, from $3x^2$ on the left and Bx^2 and Cx^2 on multiplying out the right-hand side, $3=B+C$.

But we already know that $C=2$, and so
$$3=B+2$$
$$\text{or } B=3-2=1$$

Ans. $$\frac{1}{(x+1)^2}+\frac{1}{(x+1)}+\frac{2}{(x-2)}.$$

Examples for Practice.

Resolve the following into partial fractions:

1. $\frac{3x+4}{x^2+3x+2}$.
2. $\frac{5x+17}{(x+7)(x-2)}$.
3. $\frac{5x+2}{x^2-4}$.
4. $\frac{x}{(x-5)(x+4)}$.
5. $\frac{3x^2+6x-4}{(x^2-7)(x+1)}$.
6. $\frac{7x^2+25x+13}{(x+2)^2(x-1)}$.

Simultaneous Equations.

91. Let us suppose that we wish to find the values of two quantities, x and y, and only know that $5x+y=7$. Now we could have an infinite variety of values for $x+y$ which would fulfil the requirements of this equation; for example, anv of the following:

$x=10$	2	$\frac{1}{2}$	0	-10
$y=-43$	-3	$4\frac{1}{2}$	7	57

In fact, for any value we like to give to x there will *always* be a corresponding value of y which will make $5x+y$ equal to 7.

Now suppose we know also that $5x+3y=1$. This new equation, dealing with the same x and the same y, obviously limits our choice of values, for x and y have now to fit into *two* different equations instead of into one only.

We have $5x+y=7$

and $5x+3y=1$.

Now, as each left-hand expression equals its corresponding right-hand expression, we can obviously add or subtract the two left-hand expressions, and put their sum (or difference) as equal to the sum (or difference) of the two right-hand expressions.

For example, taking the two equations $5+3=8$

and $4+1=5$,

we can either add them, getting $9+4=13$

or subtract them, getting $1+2=3$.

In our particular case it will be convenient to subtract them.

$$5x+y=7$$
$$5x+3y=1$$

Subtracting $-2y=6$ or $y=-3$.

Thus we have eliminated x in the subtraction, and have been enabled to find the value of y.

Inserting this value $y=-3$ in the first of the two equations, we have

$$5x+y=7$$
$$5x-3=7$$
$$5x=10 \quad \text{or } x=2.$$

Thus the required solution is $x=2$, $y=-3$.

The following examples serve to introduce various "dodges" for the solution of simultaneous equations.

Example.

Solve the equations $2x+y=15$
$3x-5y=16$

Adding, we get $5x-4y=31$, an equation which does not help us in the slightest. Subtracting, we get $-x+6y=-1$ or $x-6y=1$, and again we are no farther forward. We must obviously adopt some new scheme in order to make either the x terms or the y terms cancel out. The easiest thing to do in the present case is to multiply the first equation all across by 5.

We then get $10x+5y=75$
Now $3x-5y=16$
Adding $13x=91$

$$\text{or } x=\frac{91}{13}=7.$$

Putting $x=7$ in the equation $2x+y=15$
we have $14+y=15$
or $y=15-14=1$.

Ans. $x=7, y=1$.

92. We know that one equation is sufficient (provided it is a suitable one) for finding the value of one unknown, and we have just seen that two equations are necessary for finding two unknowns. Similarly, three quantities can be found only if we have three equations.

Example.

Solve the following equations :

(i) $2x+5y-z=6$
(ii) $5x-8y+2z=8$
(iii) $x+2y-5z=-11$.

We will first of all eliminate z altogether, and to do this we can multiply

equation (i) by 10.....$20x+50y-10z=60$ (iv)
equation (ii) by 5 .....$25x-40y+10z=40$ (v)
and equation (iii) by 2 .....$2x+4y-10z=-22$ (vi)
Add equations (iv) and (v) .....$45x+10y=100$ (vii)
and also equations (v) and (vi) .....$27x-36y=18$ (viii)
Now multiply equation (vii) by 3...$135x+30y=300$
and equation (viii) by 5...$135x-180y=90$
Subtract .....$210y=210$

$$\text{or } y=1.$$

Put this value $y=1$ into equation (vii), and we get

$45x+10=100$
$45x=90$
or $x=2$.

Put $x=2$ and $y=1$ in equation (i), and we get

$$4+5-z=6$$
$$9-z=6$$
$$z=3$$

Ans. $x=2, y=1, z=3.$

Example.

Find the values of x and y in the equation $y=mx+c$, given that

when $m=1{\cdot}2$, $c=4{\cdot}8$

and when $m=0{\cdot}5$, $c=6{\cdot}2$.

Inserting these values of m and c in the equation, we get

$$y=1{\cdot}2x+4{\cdot}8 \quad \text{(i)}$$
$$\text{and } y=0{\cdot}5x+6{\cdot}2 \quad \text{(ii)}$$

Multiply (i) by 0·5 ... $0{\cdot}5y=0{\cdot}6x+2{\cdot}4$ (iii)

and (ii) by 1·2 ... $1{\cdot}2y=0{\cdot}6x+7{\cdot}44$ (iv)

Subtract (iii) from (iv) ..... $0{\cdot}7y=5{\cdot}04$

$$\text{or } y=\frac{5{\cdot}04}{{\cdot}7}=7{\cdot}2.$$

Inserting the value $y=7{\cdot}2$ in equation (i), we get

$$7{\cdot}2=1{\cdot}2x+4{\cdot}8$$
$$1{\cdot}2x=2{\cdot}4$$
$$\text{or } x=2.$$

Ans. $x=2, y=7{\cdot}2.$

Examples for Practice.

Solve the following:

7. $\begin{cases} 3x+5y=25 \\ 2x-3y=4 \end{cases}$

8. $\begin{cases} x+2y=1 \\ 3x-5y=-19 \end{cases}$

9. $\begin{cases} 2a+3=-b \\ 2b+4=-5a \end{cases}$

10. $\begin{cases} 11+2p=8q \\ p+2q=8 \end{cases}$

Find x and y in the following cases:

11. $y=mx+c$

Given that $c=7$ when $m=1$

and $c=8$ when $m=\frac{1}{2}$.

12. $ay-x=b$

Given that $a=7\frac{1}{2}$ when $b=4$

and $a=13$ when $b=15$.

Share Market Report

LONDON, *August 15th*, 1916.

SINCE our last issue there has been rather less business and prices generally a little easier with the exception of Marconi Marine, which have risen 5s. The Ordinary shares are now ex dividend. Marconi Ordinary, £3 3s. 1½d.; Marconi Preference, £2 12s. 6d.; Marconi International Marine, £2 6s. 3d.; American Marconi, 18s. 3d.; Canadian Marconi, 11s.; Spanish and General Wireless Trust, 10s. 9d.

Radio Farm

Professor Sparkington Gapp takes to Agriculture

By P. W. HARRIS

It was a typical summer's day (temperature 40°, steady rain). Soaked to the skin, I trudged along, vainly endeavouring to shelter myself under the tall trees which skirted the road, and vowing black vengeance upon the friend who had recommended a walking tour in Wiltshire. Great was my joy when around a bend appeared the joyous sign of the "Fly and Thunderbolt," an ancient hostel promising welcome refuge and refreshment.

"First customer to-day!" remarked the landlord dismally as he handed me a foaming tankard.

"Oh! Why this lack of trade?" I asked, sinking into a cosy settle.

"People joining the Army and moving and so forth. There's a cranky old professor running a farm here, who hasn't improved matters either!"

"A professor!" I exclaimed with interest. "Who is he?"

"Name of Sparkington Gapp," replied the host. "Tries to run a farm on what he calls scientific lines. Weird goings-on there are too. My old hen's been laying duck's eggs for a week, and people all round here are moving 'cause they don't know what's up with the place!"

"Sparkington Gapp! Why, he's an old friend of mine!" I cried.

"Oh, you know him, do you," said the landlord suspiciously. "Well, if you walk up the road for a quarter of a mile, until you come to a large white gate marked 'Radio Farm,' that's his place. And tell the old fossil, if you see him, that this was a Christian village till he came. Now it's haunted!"

Leaving the muttering landlord in the sanded bar, I stepped out into the road once more. A gleam of sun was now filtering through the trees, making a walk more pleasant. What a coincidence that I should come across the old professor again!

After walking for a minute or two my attention was arrested by the strange antics of a frog. The little creature had just emerged from a wayside pond and was endeavouring to cross the road. It did not progress by the usual leaps, however, but attempted to walk on the tip of its toes with its head high in the air, and then, with a great effort, it emitted a feeble "Cockadoodle-doo!" and fell over.

Thunderstruck by the strange phenomenon, my mind instantly reverted to the conversation in the "Fly and Thunderbolt." "The place is haunted!" the landlord had said. Truly there was something wrong. What influence was at work, I wondered, to change the poor frog's nature so peculiarly.

After a while I reached the white gate, on which, just as the landlord had said, I saw painted in large letters "Radio Farm. Beware of the Wireless." Without pausing, I pushed it open and entered an avenue which soon terminated in an open field. In the distance I could see a group of buildings and a large umbrella aerial. Stepping out at a good pace, I inhaled the delightful air, when suddenly

without warning I was thrown to the ground by a violent blow on the chest and legs. Picking myself up, I looked around, but could see nothing; so, considerably mystified, I started my walk again, only to be once more overthrown in precisely the same fashion.

"You can't walk through my wireless fence that way," said a voice from a hedge. "Why, bless me, if it isn't the young man from THE WIRELESS WORLD!"

Turning, I saw my friend the Professor, who was beaming with pleasure and looking the picture of health.

"How do you do, Professor?" I said. "Down at the inn I was told you had a farm here, so I came along to see it. I am sure WIRELESS WORLD readers will be delighted to hear of your latest invention."

"I am sure I shall be only too pleased to show you round," courteously replied the famous scientist. "Since turning my attention to agriculture I have achieved some remarkable successes. But first of all I must let you in." And stepping to a tiny box fastened to a tree, he pressed a button.

"What's that for?" I asked.

"Just to release a section of the wireless fence. Quite a simple idea, you know, the same as a wire fence except that it has no wires, hence its invisibility and your somersault just now. Pray step forward, the way is clear."

We were now in a large field, rich and green and affording excellent pasture for the herd of cows I observed about me. The animals were evidently in good condition, although they had a strange, tired look in their eyes.

"Each cow is allotted so many square feet of grass, and is separated from its neighbour by a low wireless fence," explained Professor Gapp. "You don't see the fences, of course, as having no wire they consequently need no posts to support the wire."

"They are self-supporting, then?"

"Completely. They cost us nothing whatever," was the reply.

From the distant buildings came the sound of a deep bell announcing the passing of three o'clock. Then to my astonishment every cow seemed suddenly galvanised into activity and tore across the field to a long low building, into which it disappeared. Within two minutes the pasture was completely deserted.

"What on earth is the matter?" I exclaimed.

"Milking time," said my guide with pride. 'We milk them every two hours. As soon as the clock strikes an impulse is sent from the main antenna and actuates a coherer tied to the cow's tail. A small relay brings a prickly instrument into circuit and forcibly impels the animals to rush to the shed. There they are milked, by means of a high-frequency oscillatory milkulator (up and down

"THERE'S A CRANKY OLD PROFESSOR RUNNING A FARM HERE."

"EVERY COW . . . . TORE ACROSS THE FIELD TO A LONG, LOW BUILDING."

five hundred times per second), and given a pail of phosphorus tonic. At the right moment the jabber comes into action again, and the cows run back to their stations."

And sure enough forty-eight panting Alderneys came tearing out of the shed to take up positions in the field once more.

"Efficiency every time," I said admiringly.

"That's the motto here," smiled the Professor. "In the old-fashioned farms the cows are slowly driven backwards and forwards to the sheds by hand, and at the most are milked twice a day. Here we speed them up and renew their energy with tonic. The phosphorus makes them very intelligent too," continued the scientist.

"Yes?" I said interrogatively.

"Very intelligent indeed. Of course, we do not expect them to attain the intellectual level of a human being, but we already have several who have reached the intelligence of a Cabinet Minister. But come and see the eggery."

We now walked into a large red brick building lined with white tiles and fitted with a number of glass boxes. In each I observed a scared hen, and the whole structure echoed with what seemed like the tapping of a hundred tiny hammers. Mystified, I turned to my guide again. "Please explain," I asked plaintively.

"The noise you hear proceeds from the constant laying of eggs," was the answer. "Let me look at the speedometer. Ah! four hundred. Yes, the speed is improving daily. We have forty hens here, so that means ten eggs per minute from each hen."

"Ten eggs a minute! Good gracious, how on earth do you manage that?"

"Quite simply," explained the Professor. "Look at this main controlling device." Here we paused before a large case in which I saw a fine hen surrounded by inductances and capacities. Two little bulbs were glowing at one end of the case. "This master hen (or perhaps I should say mistress hen) has in its brain the desire

to lay eggs. This it transmits to the capacity and inductance to which it is attached, and the two bulbs (vacuum valves, you know) amplify the desire one thousand times and radiate it to the other hens about."

"Marvellous!"

"Yes, I must admit it is somewhat above the ordinary. We have had a great deal of trouble, however, in getting the best adjustment. One day the apparatus went off resonance and upset the cows, who started to build nests. We still have a little leakage somewhere."

"That would account for the strange behaviour of a frog I passed in the road. It was trying to crow!"

"Yes, frogs have a similar wave-length. And last week three of my assistants caught chicken-pox through touching the hen without the customary rubber gloves."

"Does not working at high pressure exhaust the hens rapidly?" I next asked.

"Fairly rapidly," replied Professor Gapp. "We work them in relays, the birds off duty being fed on concentrated food, so as to bring up their strength again. Of course they age rapidly, and when they die we sell their flesh for leather."

"Absolutely everything thought of!" I exclaimed.

"Well, we are not perfect," modestly replied my guide, "but we are improving steadily."

The Professor now opened a door and ushered me into the main operating-room, where the hum of machinery made it necessary for us to raise our voices. Seated at various tables were a number of bespectacled young men, each with a chart and a number of switches before him. The centre of the room was occupied by a number of large arc generators, and through the roof projected the insulators of the main aerial.

"These switches," said the Professor, indicating a number of glistening brass handles on a table, "control the condensers of the condensed milk plant. Butter-making is manipulated by the operator at the further table. Cream is first placed in a large capacity connected to a suitable inductance and spark gap. The cream, of course, oscillates in the condenser and inductance, and as a result is rapidly converted into excellent butter. The time-constant of the circuit is adjusted so as to give a pound of butter every five seconds."

"What happens to the butter-milk, then?" I asked.

"There is none," replied my friend. "It all evaporates in the spark gap."

"How you think of every little detail!"

"Yes, I admit we are thorough. Our trouble at present is lack of control of the weather. I have a scheme, however, which I think will solve the problem."

"How do you propose to work it?"

"Well, I cannot reveal details at present, but I may say that by a suitable combination of umbrella aerials and dry cells we hope to get wet and dry weather at will."

What a brain! Such wonderful inventive power! And yet the British neglect of their scientists is proverbial!

"Thank you a thousand times for your kind explanation," I said. "There

"IN EACH I OBSERVED A SCARED HEN."

is just one point I would like explained before I leave. Whence do you obtain the power to run this plant?"

"Oh, that's easily arranged from the surplus cheese," the Professor answered. "One high-potential Stilton, stepped down through a transformer, will run this plant for a whole day."

"Thank you very much. Now I must be going. Which way must I walk to reach the village?"

"My dear sir, you mustn't walk! I couldn't allow it! Here, Simpkins, take this gentleman down to the village in my aeroplane."

"Your aeroplane! So you have aircraft here?"

"Certainly. Since reading those articles in THE WIRELESS WORLD on Wireless and Aircraft I have experimented a great deal in that direction. We are improving daily, aren't we? 'Experientia Dowsett,' you know! Good-bye!"

"Good-bye! I shouted down as the Farman machine glided into the ethereal blue and the figure of the grand old professor dwindled to a speck on the earth beneath.

And then, far away beneath, I watched the cows scurrying away to the five o'clock milking, whilst from the building below came the monotonous "tap-tap" of the new-laid eggs as they fell into their appointed receptacles.

Engineering in China

As there is a proposed considerable extension to the engineering department of the Pekin University, the Chancellor expressed a desire that models and samples of engineering products of the United Kingdom should be available. The British Engineers' Association, through their energetic secretary, took the matter in hand, pointing out the great possibilities of the Chinese market in connection with engineering generally, and especially the opportunities which are likely to arise for the British manufacturer after the war. Gifts of specific articles of plant and machinery specially required by the students of the University were solicited, and have been freely made. Among those who have offered gifts of plant to the University are Marconi's Wireless Telegraph Co. It is very satisfactory to note that at least as regards the British manufacturers they appear alive as to the future of that market.

A New Edition of "Bangay"

So great has been the popularity of the *Elementary Principles of Wireless Telegraphy*, by R. D. Bangay, that the publishers have now arranged to produce a new revised and enlarged edition at an early date. The price of the new edition will be slightly increased.

The Library Table

"THE HEART OF EUROPE." By Ralph Adams Cram, Litt.D., LL.D., F.A.I.A., A.N.A., F.R.G.S. London: Macmillan & Co., Ltd. 1916. 10s. 6d. net.

This pleasingly-written work describes in a more or less detailed manner some of the beautiful architecture of the important buildings in what the author refers to as "The Heart of Europe." This cognomen would seem to be particularly applicable. Contemporaneously with the Norman invasion of England there sprang into being in northern France, Flanders, and western Germany the elements of a permanent civilisation. This civilisation commenced to develop through the unspotted efforts of the Church in the twelfth, thirteenth and fourteenth centuries, expanded and enlarged with the careful handling of the guilds and corporate bodies of the fifteenth century, and was finally consummated by the burghers and people of the sixteenth and seventeenth centuries. The divisions of this progress are exemplified in the priceless architectural treasures, which are the heritage, not only of the countries in which they are situated, but of the whole civilised world. Alas! the ogre of war has heavily planted his foot on this once prosperous district. As the result of the barbarous procedure of the modern Huns, many a fine old building now lies in ruins—razed to the ground. And why? With their usual aptitude for excusing their misdeeds, the Germans have proclaimed to the world that military necessity demanded their destruction because they were used by the Allies as observation and signalling posts. The argument that wireless telegraphic masts were erected on the towers, and apparatus set up in the interior of the churches, forms the exact type of excuse that, by custom, we expect from those who so callously and brutally disregard the common principles of humanity. The book is profusely illustrated, and Dr. Cram's fluent style possesses a charm which we are sure will appeal to all our readers.

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"AIRCRAFT IN WAR AND PEACE." By William A. Robson. London: Macmillan & Co., Ltd., 1916. 2s. 6d. net.

To quote the author in his preface to the book, he has "attempted to convey, "in plain non-technical language, a general idea of the conditions under which "aircraft is playing its part in the war, and also to indicate the chief directions

" in which it is developing." The potentialities and scope of aircraft have probably increased more rapidly during the present embroglio than would have been the case had no war existed. The subject is indeed fascinating, and all those who like to learn and read of the rapid strides being made are advised to procure the book. It is well illustrated, but we think the text might have been considerably " polished." It is somewhat crude in places.

The uses of wireless telegraphy in connection with aeronautics have become very firmly established, and it is seldom now that any important reconnaissances are carried out without the employment of Senatore Marconi's valuable invention.

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" ALTERNATING CURRENTS: THEIR ELEMENTS EXPLAINED AND THEIR CALCULATION EFFECTED WITHOUT THE USE OF HYPERBOLIC FUNCTIONS." By H. R. Kempe. London: Crosby Lockwood & Son. 3s. 6d. net.

The increasing importance of alternating currents in electrical engineering practice and the difficulties encountered by the student in making calculations relating thereto has already called forth a large number of books devoted to the subject. In this book the author endeavours " not only to explain the practical " application of formulæ given in existing text-books, but also to show by what " processes they may be obtained." The author was for some time principal staff engineer and electrician to the British Post Office, and therefore has had a large experience of electrical calculations in practical work. It has been stated by Professor Morecroft that problems in which the current has a continually changing value in consecutive sections of the line, due either to leakage between the two sides of the line or to the capacity of the line, can be accurately solved *only* by the use of hyperbolic trigonometry. In this book Mr. Kempe shows that his statement is hardly a correct one. The volume will no doubt interest many students who wish to go a little more deeply into the subject than is the general rule.

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" THE AEROPLANE." By A. Fage, A.R.C.Sc. London: Charles Griffin & Co., Ltd. 6s. net.

When reviewing the first edition of this book in November last we felt sure that it would make a great appeal to all who are concerned with scientific problems of aviation and the practical construction of aeroplanes. That we were justified in so thinking is proved by the fact that a second and enlarged edition has now been produced. So rapid has been the progress of aviation in the last six months that much new material has had to be added, with the result that we now find over twenty additional pages and some further illustrations. As we stated in the previous review, the book is a scientific work rather than a popular treatise; nevertheless, there are many parts which will interest the lay reader, particularly if he has some acquaintance with engineering. For the practical engineer who intends to take up the study of aviation the book can be highly recommended, and without a doubt the present edition will be exhausted as rapidly as the first.

NOTE.—*Any of the above books will be forwarded by return of post upon receipt of remittance covering cost of book and postage, by the Wireless Press, Ltd., Marconi House, Strand, W.C.*

Personal Notes

It is our sad duty this month to record the death in action of Pte. John N. W. Green. He first joined the London office of the Marconi Company (Transfer Dept.) in August, 1911, where he remained until October, 1913, in the latter month being transferred to the Belgian Marconi Company. He enlisted, with several members of the London Marconi Company, in the 17th Royal Fusiliers. After some months' training he went to the front in November, 1915, but in an attack on July 27th last he was shot through the lungs and died instantaneously. In a letter which his father received from the Major commanding his company, the following passage occurs :

" He was a very gallant soldier, and died in a charge against the enemy. I am " proud to have had men like your son under my command."

Pte. Green is an only son, and had he lived would have been 21 next month. He was educated at the Mercers' School, Holborn. We are sure the whole-hearted sympathy of our readers will go out to his bereaved father in his time of trouble.

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Members of the Marconi Company's Marine Operating Staff will be interested to hear that Mr. Reginald Cox, who for some time has been engaged upon inspection duties at Avonmouth and Cardiff, entered the married state at the end of June last.

The wedding took place at the pretty little parish church of St. George, Waterlooville, before a large assembly of friends. The bride, Miss Gladys Irene Edwards, is the elder daughter of Lieut.-Commander and Mrs. J. Edwards, of Waterlooville, and was given away by her father. As this is a technical magazine, we will not attempt to describe the dresses worn,

THE LATE PTE. J. N. W. GREEN.

but we understand that everybody looked charming, and everything went off remarkably well. Mr. Cox's *confrères* in the Marconi Company presented the bridal couple with a handsome barometer as a token of their esteem, and we join with the staff in wishing Mr. and Mrs. Cox every happiness.

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Among the members of the Marconi Company's staff who joined the Army in 1914 was Mr. Frederick Thomasson, who entered the company in 1913. Becoming attached to a wireless section, he had many exciting experiences, and we have just heard that he has been released from hospital, where he spent many months in recovering from severe wounds received in action. He has now been awarded the Croix de Guerre by the French military authorities for conspicuous bravery in action. We are sure our readers will join with us in tendering him our hearty congratulations upon his safe recovery and the decoration awarded him for his gallantry.

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We regret to announce that Wireless Telegraphist James Bertram Dalgleich has lost his life whilst serving his country. He was in his nineteenth year, and resided at Higher Tranmere. His former place of residence was Bootle, and he was well known in the Boys' Brigade there.

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SERGEANT RUMFORD.

Our photograph is of Sergeant Rumford, of the Royal Flying Corps. He is a wireless operator, and whilst in flight over the German lines was shot in the head by enemy airmen, the bullet passing out at the neck. Fortunately he safely reached the British lines, and has since made a complete recovery. The sequel to the incident is that he has been presented at Aldershot with the Russian Order of St. George. He is now at the front again.

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Commander A. E. Silvertop, of H.M.S. *Defence*, which was sunk in the great naval battle off Denmark, was one of the earliest experimenters with wireless telegraphy in the Navy, and was lent to the Somaliland Expedition of 1903 with two sets of Marconi apparatus. By his untimely death the Navy and the nation lose a valuable officer.

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Among the men who went down with H.M.S. *Defence* in the Jutland battle was Wireless Operator Ernest Edward Dawes, the son of a widow living in Catford. He was between 18 and 19 years of age, and had been in the Navy about eighteen months. Our sincere condolences go out to his mother.

Patent Record

3164. March 2nd. Marconi's Wireless Telegraph Co., Ltd., and H. A. Ewen. Means for suspending and insulating electrical conductors.

3165. March 2nd. Marconi's Wireless Telegraph Co., Ltd., and H. M. Dowsett. Studs or electrodes of electric dischargers.

3166. March 2nd. Improvements in wireless installations for aeroplanes.

3233. March 3rd. Marconi's Wireless Telegraph Co., Ltd., and H. A. Ewen. Improvements in measuring instruments, relays, and the like.

3391. March 7th. British Thomson-Houston Co., Ltd. (General Electric Co.). Vacuum apparatus.

3394. March 7th. H. W. Sullivan. Telegraphic or signalling systems.

3515. March 9th. British Thomson-Houston Co., Ltd. (General Electric Co.). Electron discharge devices.

3533. March 9th. Signal Gesellschaft. Multiple contact microphones. (Convention date, Germany, January 9th, 1915.) (*Accepted.* Patent No. 100156.)

3603. March 10th. British Thomson-Houston Co., Ltd. (General Electric Co.). Means for obtaining high vacua.

3743. March 13th. M. Compare and the Comparri Wireless Control Syndicate. Oscillators or vibrators for wireless telegraphy.

3745. March 13th. Société Française Radio-electrique. Alternators for the production of high-frequency electric oscillations. (Convention date, France, March 13th, 1915.) (*Open to public inspection.* Patent No. 100184.)

3789. March 14th. Marconi's Wireless Telegraph Co., Ltd., and H. A. Ewen. Improvements in measuring instruments, relays, and the like.

3948. March 17th. F. Titterton. Apparatus for transmitting signals.

4096. March 20th. H. Rottenburg. Electric contact keys and buzzers.

4184. March 21st. W. A. Clark, H. G. and W. W. Longford, T. Morris, and the Sphinx Manufacturing Co. Electrical condensers and condenser systems.

4247. March 22nd. British Thomson-Houston Co., Ltd. (General Electric Co.) Electrical transformers.

4295. March 23rd. E. R. Clark. Inductances for wireless telegraphy and method of manufacture thereof.

4320. March 23rd. A. E. McColl. Protecting gear for electric circuits.

4321. March 23rd. A. E. McColl. Means for protecting alternating current generators and transformers.

4399. March 24th. British Thomson-Houston Co., Ltd. (General Electric Co.) Method of controlling mechanism for electric circuits.

4518. March 27. A. Artom. Receiving instrument for wireless signalling.

4558. March 28th. British Thomson-Houston Co., Ltd. (General Electric Co.). Electric discharge apparatus.

4697. March 29th. Electric oscillators.

4733. March 31st. A. E. McColl. Alternating current system.

4816. April 1st. British Thomson-Houston Co., Ltd. (General Electric Co.). Wireless signalling systems.

4959. April 5th. L. de Forest. Electrical means for producing musical notes. (Convention date, United States, April 24th, 1915.)

5111. April 6th. C. P. Ryan. Sound-receiving apparatus.

Pastimes for Operators

IV.—STUDY

By JOHN WALTON

AN article on study may be legitimately included in this "pastime" series, for surely even the most frivolously inclined do not view amusement as their only means of "passing the time."

Some of us after our days at sea are over, when we find ourselves in strenuous occupation ashore, become exercised with grave doubts as to whether we have wisely used the spare time which was ours, afloat, and regret too late that we shall never have such an opportunity again. Of course, it is useless to "cry "over spilt milk"; but I do feel that I may be doing good service to some of my colleagues in pointing out that, however true the old "saw" may be, which deals with the effect of "all work and no play," even more deplorable are the results of "all play and no work." I have read with much interest and pleasure previous articles in this series, dealing with the subjects of "Banjo Playing" and "Photo-"graphy," but these only appear to touch the fringe of the possibilities available for wireless operators at sea. I should like to suggest for serious consideration the fact that we do not want to remain operators at sea all our lives; we look forward to obtaining other employment and "bettering ourselves" from the point of view of salary. We cannot realise too soon that good jobs ashore at good money have to be worked for, and the man who wants them has got to *know something*. Moreover, there is not only the selfish but the national point of view to be considered. We have not merely to beat the enemy in warfare on land and sea, but also to contend in serious strife with him for the trade of the world. Only individual capacity can help us in this latter contest.

I will confine myself to suggesting subjects which may be studied and mastered from the instruction books without the aid of a tutor. They are subjects, moreover, which a pretty extensive experience of business suggests as being the most useful for general commercial life. Several of them have doubtless been included in the curriculum of your school, but I think my own experience may fairly be taken as typical; and the result of my mental stocktaking is a feeling of surprise at the lack of practical business value of what I learned as a schoolboy.

BOOK-KEEPING.

Undoubtedly the best book on this subject is *The Students' Complete Commercial Book-keeping*, by Arthur Fieldhouse, published at 4s. The principles of the science are here thoroughly taught, while the practice of the art and current business methods receive their due share of attention. Do not forget that you are learning not to keep the books of any particular trade, but the principles of book-keeping and their general application which may be applied to a specific business later on. Besides the text-book all you want is a supply of foolscap ruled with cash columns.

Book-keeping sounds dry; but I have found it an interesting study, and a

really useful knowledge of the subject can be picked up in a year or so. If you desire to gain certificates (and they are very often a recommendation to a prospective employer) the Society of Arts hold examinations annually and issue Certificates, Grades I., II., and III. A person with, say, a Society of Arts Grade II. certificate is a useful acquisition to any business man's office, and employers have their eyes open for these things.

Shorthand.

There are quite a number of shorthand systems on the market at the present time, each claiming to be the easiest and best, but the almost universal popularity of Pitman's and the failure of its young rivals to obtain any substantial following show that the oldest is still the best.

Pitman's Shorthand Instructor, published at 3s. 6d., a plain ruled book, a little patience, perseverance, and regular practice are all you absolutely require, although Pitman's weekly penny shorthand paper, *The Journal*, forms a useful addition, especially for those who are self-taught. One year's ordinary work should enable you to take down an ordinary letter. I am no "Shorthand Expert," but that amount of study has enabled me to take notes of instructions given and reproduce them in my letters; every chief likes to see his own expressions made use of. As for fear of "sticking in a rut" because you know shorthand, the idea is a simple bogey. If you are born for "a rut," a "rutter" you will be. But do not put it down against your shorthand.

Typewriting.

For all-round business equipment it is undoubtedly desirable to have a knowledge of typewriting and be able to type rapidly. It can hardly be regarded as a separate subject for study—there isn't really anything to study. Buy a second-hand machine for £3 to £5, get a booklet from a typewriting company, and you can spend many a profitable leisure hour in practising the fingering recommended and suiting it to your own idiosyncracies. Do not be satisfied to use one finger, if you can possibly avoid it.

English, Reading, etc.

It is really surprising how rare is the gift of being able to write the King's English well, and yet the ability to do so is one of the things which should be regarded as essential to the aspirant for commercial honours. Apparently it is not entirely a matter of schooling, for I have known men who have been to the Universities who were unable to write a really fluent letter. On the other hand there are those who can outdo Micawber, who never saw the inside of anything higher than a Board School. Nor is it altogether a question of the rules of grammar. I admit that the person who writes well must necessarily have been taught the rudiments of English grammar, but I am still inclined to think there is in it something of what the Londoner said to the professor who was trying to speak Cockney: "Yer can't do it, guv'nor; it's a gift." However, be that as it may, there is no denying the fact that the reading of a really well written letter is one of the pleasures, if one of the rarities, of business life. I suppose there is no royal road to the acquisition of a good style, but a book like W. Stewart Thomson's *Practical Guide to English Composition and Essay Writing* (Simpkin, Marshall) cannot fail to be of value to any who are weak

in this direction. Diligent reading of the best English authors is also of great assistance.*

While on the subject of English I should like to mention the desirability of being able to make a succinct précis of a batch of correspondence or a number of documents. If we take the marking in Civil Service Examinations as a criterion it would appear that few are able to do this well, for it is a subject in which low marks are the rule. At one examination at which I sat I thought my précis was excellent, but the examiner evidently thought otherwise, and gave me only 160 marks out of 300! Take a newspaper and read a speech reported verbatim in two columns. Try and summarise into twenty or thirty lines, and then compare the result with the sub-editor's work in the Summary Column. You'll soon see the difference!

TECHNICAL.

In addition to the ordinary commercial subjects mentioned there is perhaps an even wider field for study in the direction of technical matters. There are few more interesting subjects than electricity. We are naturally most concerned with its application to telegraphy, and I will confine my remarks to that aspect of the question, although, if you are so inclined, the study of other branches of the science, such as lighting, heating, and power, may advantageously be undertaken.

For students of all scientific and technical subjects a knowledge of mathematics is very desirable, perhaps even essential. I am afraid my mathematics were somewhat neglected at school. At least, when I began to study telegraphy I found my knowledge so rusty that I had to revise pretty extensively. If you are in the same sad plight you will find Castle's *Practical Mathematics for Beginners* (Macmillan, 2s. 6d.) a handy little volume for bringing you "up to scratch." It contains quite enough for the requirements of ordinary students, whose object is mainly to secure facility in the accurate handling of equations, algebraic formula, etc.

MAGNETISM AND ELECTRICITY.

All branches of electrical engineering are dependent upon the application of the phenomena of magnetism and electricity, and the student of electrical subjects is therefore best equipped whose knowledge of the fundamental principles is greatest. With a really thorough groundwork of magnetism and electricity subsequent study of any department of electrical science is comparatively easy; without it no really advanced knowledge either in "wired" or "wireless" is possible.

The subject is an unusually interesting one and in view of its importance deserves careful attention. A very useful and popular book is Hadley's *Magnetism and Electricity for Beginners* (Macmillan, 2s. 6d.), which covers all the ground required to secure the Board of Education's Lower Grade Certificate. For more advanced students the same author's *Magnetism and Electricity for Students* (Macmillan, 6s.) can be thoroughly recommended. The average student would perhaps not require to go beyond the first book, which gives a sufficiently wide treatment of the subject to cover practically all one's needs in telegraphy and telephony. The second book is, however, a valuable contribution to the current literature on the subject, which it treats very exhaustively, and for those studying for the Stage II. examination of

* Try *How to Fail in Literature*, by Andrew Lang. It is most amusing, and instructs on the "what to avoid" principle.—(ED.)

the Board of Education it cannot be beaten. Of course an invaluable text-book on the subject is the new edition of Sylvanus Thompson's *Electricity and Magnetism* (Macmillan, 4s. 6d.).*

Telegraphy.

To begin with wireless. Although you hold a 1st class P.M.G. you don't really know such a very great deal about the science of wireless telegraphy. From three to six months in the School is not, after all, a great deal to devote to a subject which is of such enthralling interest and for which the future possibilities are so vast. There is still room in this sphere for the inventive genius, and there may be much money and no little fame for those who are able to suggest practical improvements whereby wireless may achieve still further triumphs. And bear this in mind, it isn't always the big engineers who fall on the big ideas. Yes, undoubtedly you might do worse than make a deeper study of wireless. Moreover, your practical association with the work will naturally add to its interest and will also be found very helpful.

Besides wireless, however, there is a very wide field to cover in the study of landline and cable telegraphy. If you are a good wireless operator you will naturally be efficient in an operating capacity ashore, but your usefulness, even as an operator only, will be enhanced by your knowledge of theory, to say nothing of your greatly increased chances of promotion. It is a fallacy to suppose that "line" telegraphy is on its "last legs." Don't believe it. It certainly won't be in our time that all the telegraph wires and cables will be scrapped. So that when you get that comfortable little berth ashore you will naturally be a more valuable servant if you have made a study of modern telegraphic systems as applied to overhead and underground lines and also submarine cables. The book that will cover all your requirements in this direction is Herbert's *Telegraphy* (Whittaker & Co., 7s. 6d.). It is a very comprehensive treatise on telegraphy and starts by assuming that you have no knowledge of the subject whatever, eventually taking you by gradual stages over all the ground required even by a telegraph engineer, which is probably a good deal more than you will want. All forms of automatic working at present in use are thoroughly explained and there are also chapters dealing with line construction and cable laying.

The only recognised certificates in telegraphy are issued by the City and Guilds of London Institute, who hold examinations annually (at the end of April) at all the principal Technical Schools. A first class Grade I. Certificate can usually be gained by a conscientious student who gives an hour a day to the subject for, say, five or six months. The Grade II. (or Honours) Certificate naturally takes more getting, but by the following April a man who is keen may sit at the examination with some degree of confidence. A first class in this grade is, I believe, recognised as the highest certificate that can be gained in the subject.

Telephony.

A somewhat closely allied and equally interesting subject is telephony. It is perhaps not quite so difficult as telegraphy, although the universal use of the telephone makes it of no less importance. It is unlikely, however, that a knowledge of tele-

* The recommendation of electrical text-books is, of course, largely a matter of personal taste and requirements. A perusal of the "Library Table" column in The Wireless World will serve as a useful guide in technical book-buying.—(Ed.)

phony would be quite so useful or profitable to you as a good knowledge of telegraphy, that is if you intend to remain in the service of a telegraph company. But even so, the subject is one which is worthy of attention, for the telephoning public is on the increase and the development of this service is still far from complete. Poole's *Practical Telephone Handbook* (Whittaker & Co., 6s.) can safely be mentioned as a suitable book for the student.

The City and Guilds of London Institute is also the recognised examining body in this case. Grade I. and Grade II. Certificates are issued and the examinations are held about the same time as those in telegraphy—*i.e.*, towards the end of April in each year.

IN CONCLUSION.

There are no doubt quite a number of other directions in which the studious operator may set himself to work, but unfortunately there is a limit to the amount of space with which a perhaps already over-indulgent editor will favour me. At any rate, it is hoped that enough has been said to assist the operator who is not without a little ambition and who has his eyes on the future, and that he will readily be able to map out for himself a course of study suitable to his tastes. In order that the article might have a general appeal I have purposely confined myself to subjects which, after all, are comparatively simple and which can be successfully taken up by the average person. The subjects are on that account no less useful, in fact they probably represent the things which will be found of most practical value in a business or telegraphic career. Their study cannot fail to repay you and must naturally increase your earning capacity and your sphere of usefulness. It ought to be possible for you to take up something really helpful of this kind and still to have as much spare time on your hands as should properly be given to amusements pure and simple. Finally, do not overlook the fact that by increasing your individual efficiency you are acting patriotically, for you are contributing your share to the maintenance of our commercial supremacy and preparing to take a man's part in the war after the war.

A Correction

In the article on the "Disc Discharger" which appeared in our July issue the word "ignition" in the sixteenth line on page 263 should be "ionization."

On the next page it is stated that the disc is usually provided with two studs per pole of the alternator. Only one stud per pole is used in the majority of cases, giving one spark per half period; but the disc is usually drilled and tapped for two studs per pole so that two sparks per half period may be used in suitable cases.

From New York "Life"

NAVAL COMMANDER: "Did you succeed in intercepting that wireless message to the enemy?" Operator: "Yes, sir. It was addressed to Lieut. Smith, and read, 'It's a boy.'"

Readers are invited to send questions on technical and general problems that arise in the course of their work or in their study to the Editor, THE WIRELESS WORLD, *Marconi House, Strand, London, W.C. Such questions must be accompanied by the name and address of the writer, otherwise they will remain unanswered: and it must be clearly understood that owing to the Defence of the Realm Act we are totally unable to answer any questions on the construction of apparatus during the present emergency.*

POSITIVELY NO QUESTIONS ANSWERED BY POST.

NOTE.—*In view of the large number of questions which now reach us from readers, we regret that we cannot undertake always to answer queries in the next issue following the receipt of letters. Every endeavour will be made to publish answers expeditiously.*

E. P. (Colchester).—We hope to publish next month an article on the training of radio-telegraphists for the naval and military services, which we think will contain the information for which you ask in your first question. (2) Frank Castle's *Practical Mathematics for Technical Students* costs 3s. 6d.; post free, 3s. 10d. from our publishers. We thank you for your appreciative remarks.

M. L. B. (Pocklington).—Land stations in this country are controlled by (1) the Admiralty, (2) the Post Office, (3) the Marconi Company. Operators for the Admiralty stations are selected from the wireless telegraph staff of the Navy; operators for the Post Office stations are recruited from the Inland Telegraph staff and given a special training; operators for the Marconi Company's land stations are all experienced telegraphists who have been given special training by the Marconi Company, and vacancies do not occur very frequently. By far the greatest number of vacancies occur in the Mercantile Marine operating staff, and vacancies on land stations abroad are often filled by men who have had two or three years' experience at sea. If you are new to both telegraphy and wireless work, you will stand very little chance of obtaining employment in a land station either in the United Kingdom or abroad. In reply to your second query, our statement in the August issue that the "age limit of the Marconi Company is 25," means simply that no applicant is accepted who is past this age. Once the man is in the company, however, he will never have to leave because he is too old. If he remains until the age of 60 he will receive a pension. Question 3. See the advertisement pages of THE WIRELESS WORLD for particulars of training schools.

F. J. F. (Nottingham).—A thoroughly sound knowledge of the theory of wireless telegraphy can be obtained by studying *The Elementary Principles of Wireless Telegraphy*, by R. D. Bangay, price 1s., post free 1s. 2d., and *The Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead and H. M. Dowsett, price 3s. 6d., post free 3s. 10d. The first of these books deals mainly with the principles, and the second with the actual apparatus and its manipulation. It is, of course, impossible to learn actual operating and manipulation of the apparatus without attending some training establishment where an installation is available. Most of the training schools advertising in THE WIRELESS WORLD possess such installations for instructional purposes.

PUZZLED (Muswell Hill), writes: "Enclosed "is a sketch of the three circuits of a multiple "tuner from the handbook of Hawkhead. "The primary inductance is shown in two "sections. If this is correct, is there not a "loss of inductance, as it seems to me that only "the inductance of the coil or helix affecting "the intermediate circuit is being worked? "Again it appears that the intermediate "circuit is not adjustable like the primary, "but depends upon its condenser, and I have "always understood that on theoretical "grounds the less C and the more L is better."

Answer.—If our correspondent will study

the circuits of the multiple tuner carefully he will find that the inductance in the aerial circuit serves two purposes. The aerial tuning inductance is designed to *increase the wave-length* of the aerial, so that longer wave-lengths may be received than would be possible if no aerial tuning inductance were in circuit. The inductance coil affecting the intermediate circuits is used for *coupling* purposes only. On the "stand-bi" adjustment this coupling coil is not in circuit at all. With regard to the intermediate circuit, this is adjustable for a large range of wave-lengths by means of the variable capacity, as it is found better to adjust the circuit this way than by varying the inductance. It is true that in a detector circuit using the valve receiver or certain types of crystal, it is best to have the capacity small and the inductance as large as possible, but this does not apply to an intermediate circuit where the object is merely to pass the oscillation from one circuit to another.

W. H. S. (Broadstairs).—(1) You are quite right regarding the word "knot." This word is much misused, and many writers think that it is a measure of distance, whereas in reality it is a measure of speed. "Twelve knots" means "12 nautical miles per hour." One frequently sees such an expression as this: "The ship was travelling at 12 knots an hour," which is, of course, absurd, meaning that the ship was travelling at a speed of 12 nautical miles per hour per hour! (2) and (3) There is no regulation which prohibits a man from studying the theory and construction of wireless apparatus, but he must do nothing in the constructional line. The back numbers of THE WIRELESS WORLD contain many extremely useful articles dealing with the calculation of wireless apparatus, and our publishers are shortly bringing out a book on such calculations which will be of great value to you. You will see an announcement in our pages in due course. (4) The Postmaster-General's examination consists of tests in sending and receiving, practical manipulation of the apparatus, and oral questioning.

M. E. (Woolwich).—The Marconi gramophone records can be made to give signals in a telephone headpiece by causing the sounds to act on a microphone in series with the telephone headpiece and a cell. The strength of the signals can then be varied by altering the distance between the gramophone and the microphone. With such an arrangement as this, it would, of course, be preferable to have long wires so that the headpiece could be situated in another room. In this way the receiving would not be affected by the sounds from the horn.

A. McC. (Glasgow) asks no less than ten questions, covering four pages of letter paper. This is rather "a tall order," considering the restrictions of our space, but we will endeavour to satisfy him this time. We take this opportunity of requesting correspondents to ask not more than four questions at a time, as we like to be able to answer as many correspondents as possible each month, so that a minimum number may be held over.

Answers.—(1) See an article which we hope to publish next month dealing with the career of wireless telegraphists in the Navy. (2) Capt. B. Newton, to whom we made reference in our December number, was a captain in the Army, and at the time was engaged upon special duties regarding which we can give our correspondent no information. (3) The senior and junior operators on board ship do not hold a rank so high as that of Chief Officer and Chief Engineer. They hold the position of honorary junior officers. (4) You ask if "wireless "telegraph engineering" is as good a branch as the other branches of engineering. This is far too broad a question for a short reply, and much depends on what you mean by "as "good." In engineering, as in many other branches of life, much depends on the man, and there are undoubtedly excellent opportunities for the clever wireless engineer. (5) An honorary officer means an officer who holds that rank by courtesy. (6) On a ship carrying two operators these two men generally do all the wireless work, although occasionally a "listener" is carried as well. (7) On large ships, messages are accepted (and the rates calculated, and charges made) at the inquiry office or purser's office, and from there sent up to the wireless cabin. On other vessels the messages are accepted and dealt with entirely in the wireless cabin. In cases where the messages are accepted at the inquiry office or in the purser's office, an official of the purser's staff either makes the calculation himself or inquires of the operator on the telephone. (8) On a ship carrying two operators it is usual for the senior and junior men to take watches of equal length; but, of course, the senior is responsible for the whole of the wireless work, and will naturally take the most important watch himself. (9) Generally speaking, the operators enjoy the same privileges as the other officers. These privileges vary with the different shipping lines. In some companies the officers are not allowed to participate in deck games in their spare time, but on ships making long voyages this is generally allowed. (10) Operators usually have comfortable quarters immediately adjacent to the operating cabin. On old ships, however, they are sometimes allotted a cabin in the first or second class portion of the ship. The arrangements with regard to meals vary considerably with the different shipping lines. On some ships the operators occupy a table in the first saloon, in others in the second saloon, on other ships, again, they dine in the officers' mess. Now we have answered all your questions, we would point out to you that if you intend to take up wireless operating, you will have to pay much greater attention to your spelling and grammar than you have done in the letter under reply. We find in it no less than

nine bad spelling errors, the frequent use of "has" for "as," and many other bad mistakes in grammar. Before worrying yourself as to whether a wireless operator in the Navy can rise to the position of an Admiral, don't you think you had better consider whether you can rise to become an operator?

MRS. M. A. H. (Birmingham).—For particulars of wireless training colleges we would refer you to the advertisement pages of THE WIRELESS WORLD. Any of these institutions will be pleased to forward you particulars on application. It is not possible to be apprenticed as a wireless operator. The best course to take is to enter one of the training schools and obtain the Postmaster-General's Certificate, and then to apply to the Marconi Company to see whether there are any vacancies at the moment. As you are close to town we would suggest that you make a personal call at one of the London schools advertised in our pages and discuss the matter with the principal. If there is any other information you require, we shall be only too pleased to give it.

FRANK DE V. (Belgian Army).—Particulars of a number of training schools will be found in THE WIRELESS WORLD, and some of these conduct correspondence courses. We would suggest that you should apply to one of these institutions for particulars.

X. Y. Z. (Portsmouth).—In reply to your query we would refer you to an article which appeared in the August, 1915, issue of THE WIRELESS WORLD, entitled "How to Become a Wireless Operator." With regard to the suggestion contained in your letter, we thank you for it, and would inform you that the matter is already under consideration.

H. B. (Barrow-in-Furness).—(1) A wireless operator employed by the Marconi Company in the merchant service commences at a salary of £1 per week, with, of course, board and lodging free on board ship. Annual increases in salary are given as set forth in the conditions of employment, which can be obtained from the Marconi International Marine Communication Co., Ltd., on application. (2) Yes, the transferring of men from one boat to another is in the hands of the Marconi Company. (3) An operator must be prepared to proceed on any ship to any part of the world as the company may require. The reason of this will be understood when it is considered that some ships remain in port for several months at a time, or lay up for the winter, and, of course, the operator cannot be kept idle all this time.

F. G. S. (British Expeditionary Force), asks: "What difficulties have to be overcome "before wireless signals can be sent from "submerged submarines."

Answer.—As the sea water is a conductor, wireless waves of the type radiated from the aerial of a ship or land station cannot be used. We are sorry that we cannot give you particulars of the latest improvements in signalling between submerged submarines, as, of course, they are veiled in secrecy at the present time.

J. McK. (Alexandria).—To explain your questions satisfactorily would take many pages, and we can only indicate a few points here. Firstly, if the spark gap remains the same, and the condenser is charged more times per second, there is bound to be an increase in *radiated* power. It may not show on the voltmeter and ammeter, but that is no proof. There are other complications to be reckoned with. When the low frequency circuit is properly adjusted to resonance for a particular frequency any alteration in this frequency will reduce the voltage on the condenser, and if the gap has been arcing the reduction in voltage may stop it. No more energy may be absorbed by the converter, but there may be less wastage. In reply to the second query, it is possible to arrange an oscillating circuit in which the condenser only discharges at every third or fourth alternation by carefully adjusting the circuit to resonance. You then obtain a building-up effect in which the amplitude increases at each alternation; some of the French stations work in this way.

Sapper (B.E.F.). — With the experience you have had we think that after the war you should stand a good chance of obtaining employment as a wireless engineer. Of course, your case could not receive consideration whilst you are with His Majesty's Forces, but as soon as you are free you should apply to the Chief Engineer, Marconi's Wireless Telegraph Company, Ltd., Marconi House, Strand, stating your qualifications and asking for conditions of employment. The prospects are good for a good man. Meanwhile obtain Bangay's *Elementary Principles*, advertised in this magazine, and, when you have mastered that, *The Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead and H. M. Dowsett. These two books should prove exactly what you require. Thank you for your good wishes, which we reciprocate.

G. B. (Millom).—Your method of Morse instruction seems to be a good one, although personally we do not favour the method of sending first with long spacing, and later on with short spacing, as this, in our opinion, makes it rather difficult for the pupils to understand the correct proportion of spacing to letters. Slow sending, we think, should be proportionately slow throughout, and this is the method we have adopted in our gramophone records, which you doubtless possess. Our experience is that pupils attain a speed of 10 or 12 words per minute fairly rapidly, and then find it very difficult to increase the speed. As soon as the pupils can receive at

10 or 12 words per minute, we think it best to give them constant practice with paragraphs sent singly all the time, occasionally introducing code as a variation and to prevent guess-work. By this system an averagely intelligent pupil practising for the time you mention should be able to read 25 words per minute in six months. It is not a bad plan to advise elementary pupils to occupy some of their time in the train, 'bus, or tram by mentally translating advertisement signs, portions of the newspaper, and so on, into morse. This is of the greatest assistance in the early stages.

G. L. (Hunstanton).—We cannot say by whom the present long-distance record is held. Stupendous distances are being spanned almost daily by some of the recently constructed high-power wireless stations, and, as many of these are engaged upon war work, we cannot give particulars as to what they are doing. As an example of what is happening, we were recently informed that practically every night signals from Honolulu are received very strongly in the Falkland Islands, and in a recently issued report Dr. Louis W. Austin, of the United States Naval Radio Service, states that at Darien, in the Panama Canal zone, signals from Nauen, near Berlin (a distance of some 5,800 miles) were received at a strength of 200 times audibility, whilst Arlington, at over 2,000 miles, was received at a strength as great as 2,000 times audibility. This means, of course, that these signals would be capable of being read at from much greater distances if suitable observations could be taken. In the words of an experienced operator, this is sufficiently strong to make the telephones jump about on the table. After the war, when we are able to write of some of the things that are going on now, we hope to give much more startling particulars even than these.

J. N. H. (Yateley).—We cannot say what conditions will exist after the war, but when peace is declared and you are free, we would suggest that you apply to the Chief Engineer, Marconi's Wireless Telegraph Co., Ltd., stating the qualifications you possess and the experience you have had, and inquire whether there is a suitable vacancy for you. Meanwhile, the *Handbook of Technical Instruction*, by J. C. Hawkhead and H. M. Dowsett, price 3s. 6d., post free 3s. 10d., will be of assistance to you.

R. J. A. (Belfast).—All applicants for entry into the Marconi Company's service have to pass a medical examination by the Company's doctor. We cannot say whether the defect you mention will be sufficiently serious to debar you from the service, and in order to make certain you would have to be examined by the Company's doctor.

A. P. T. (Towcester).—We hope to publish next month an article which will give you the information you require regarding wireless in the Army.

NEW READER (Stoke Newington).—(1) Applicants for employment on the marine operating staff of the Marconi Company must have sufficiently good eyesight to be able to carry out their duties efficiently. The fact that the applicant has to wear glasses does not debar him, provided his sight with the glasses is considered sufficiently good. (2) THE WIRELESS WORLD examinations are postponed until after the war. (3) There is no age limit for the Postmaster-General's examination. The examination comprises tests in sending and receiving, knowledge of theory, ability to trace faults in the installation on which the candidate is being examined, and a practical knowledge of the instruments. In order to pass the examination it is absolutely essential that the candidate should have practical experience of the apparatus, and this is most readily obtained by studying at one of the wireless training schools where such installations are provided.

PERIKON (Worcester).—(1) The Marconi Official Gramophone Records can be obtained from the Wireless Press, Ltd., and we would refer you to our advertising pages, where you will find full particulars. (2) In reply to your radio-goniometer question, 90° is due east, 180° due south, 270° due west and 0 or 360° due north; 94° is, therefore, practically east. (3) You should apply to the Marconi Company as soon as you are free giving particulars of yourself and asking whether they have any vacancy to offer you. Everything depends upon the conditions at the time.